Allen-Bradley

Bulletin 1395 ControlNet™ Communication Board

Firmware Rev 1.01
Compatible with
ControlNet Version 1.5

User Manual

Rockwell Automation

Important User Information

Solid state equipment has operational characteristics differing from those of electromechanical equipment. "*Safety Guidelines for the Application, Installation and Maintenance of Solid State Controls*" (Publication SGI-1.1 available from your local Allen-Bradley Sales Office or online at **http://www.ab.com/manuals/gi**) describes some important differences between solid state equipment and hard-wired electromechanical devices. Because of this difference, and also because of the wide variety of uses for solid state equipment, all persons responsible for applying this equipment must satisfy themselves that each intended application of this equipment is acceptable.

In no event will the Allen-Bradley Company be responsible or liable for indirect or consequential damages resulting from the use or application of this equipment.

The examples and diagrams in this manual are included solely for illustrative purposes. Because of the many variables and requirements associated with any particular installation, the Allen-Bradley Company cannot assume responsibility or liability for actual use based on the examples and diagrams.

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Throughout this manual we use notes to make you aware of safety considerations.

ATTENTION: Identifies information about practices or circumstances that can lead to personal injury or death, property damage, or economic loss.

Attentions help you:

- identify a hazard
- avoid the hazard
- recognize the consequences

Important: Identifies information that is especially important for successful application and understanding of the product.

Shock Hazard labels may be located on or inside the drive to alert people that dangerous voltage may be present.

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Before You Begin

Objective

This manual contains the information necessary to perform the following functions on the ControlNet® Adapter (CNA) Board:

- Install and Set-up the CNA board
- Configure the Drive for control by a PLC Controller
- Maintain and Troubleshoot the board

Audience

This manual is intended for use by expert personnel familiar with the functions of solid state drive equipment. You must be thoroughly familiar with the Bulletin 1395 and its hardware before attempting to setup or troubleshoot a ControlNet Adapter Board.

To make efficient use of this Adapter Board you must be able to operate and program an Allen-Bradley PLC controller. If you cannot, refer to the appropriate programming and operations manual for your PLC controller and obtain training from the support division before attempting to setup and program the CNA board.

Term Useage

In this manual we refer to the ControlNet Adapter board as the “CNA board” or the “Adapter”.

The Programmable Logic Controller is referred to as a “PLC®”.

ControlNet Adapter Compatibility & Features

The CNA board provides a sophisticated interface to Allen-Bradley PLC controllers and other equipment capable of communicating over ControlNet. This adapter has the following features:

- One ControlNet channel, with a redundant connector to allow for backup connection in case one cable fails.
- Compatible with all Allen-Bradley PLCs and other products that support Programmable Controller Communication Commands.
- Compatible with Allen-Bradley 1395 Drives equipped with Version 8.10 or greater software.

Safety Precautions

The following types of precautionary statements will be found in this manual.

IMPORTANT: Identifies particular areas of concern for correct board, processor or Drive operation.

ATTENTION: Identifies information about practices or circumstances that can lead to personal injury or death, property damage, or economic loss.

ATTENTION: This board contains ESD (electostatic discharge) sensitive parts and assemblies. Static control precautions are required when installing, testing, servicing, or repairing this assembly. Component damage may result if if you do not follow ESD control procedures. If you are not familiar with static control procedures, refer to Guarding Against Electrostatic Damage, Allen-Bradley Publication 8000-4.5.2, or any other applicable ESD protection handbook.

Manual Organization

Table 1.A provides a brief overview of topics covered in this manual and their location within the book.

Table 1.A.
Manual Organization

Chapter	Title	Topics
2	Introduction and Product Description	Board Identification, Hardware Content, Hardware requirements for Interfacing.
3	Configuration & Interfaces	Configuring the Drive for the CNA board and interfacing the Drive with a PLC controller.
4	Startup & Installation	Unpacking & Inspection, mounting, wiring, switch settings and configuration.
5	Troubleshooting & Maintenance	Diagnostics and Fault Messages.
6	Reference	Table of all CNA configuration and setup parameters.

Specifications

Electrical:	
Board power provided by Drive	24VDC or 115VAC
Environmental:	
Ambient Operating Temperature	0° to 60°C (32° to 140°F)
Storage Temperature	–40° to +85°C (–40° to +185°F)
Relative Humidity	5% to 95% non-condensing
Firmware Version	1.xx

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Introduction & Product Description

Chapter Objective

This chapter contains a description of the major hardware components of the ControlNet Adapter board. It is not intended to be an all encompassing technical description of each hardware component. This chapter provides information to aid service personnel in:

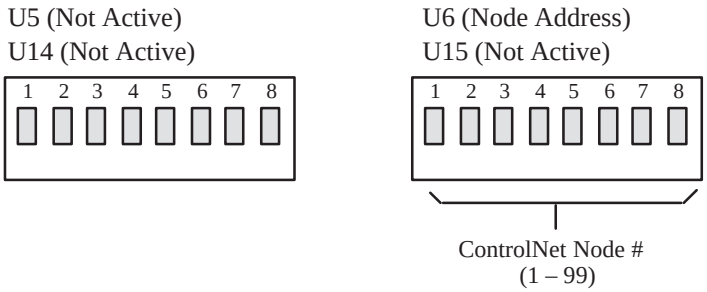
- Identifing the CNA board.
- Understanding the hardware content of the board.
- Understanding the hardware requirements necessary to interface this board with external devices.

General Board Description

The CNA board contains the hardware necessary to connect the 1395 Drive to ControlNet 1.5. Once connected, this network can be used to control, diagnose, and setup the Drive. Figure 2.1 shows the major hardware components located on this board. Refer to Figure 2.1 when attempting to identify the various hardware components.

The CNA board contains a small interface board, referred to as the Interface Plug, which contains the hardware necessary to communicate to PLC controllers via ControlNet. Refer to the installation section of this manual for further details.

DIP switch U6 is used to select the node address for the ControlNet adapter.
NOTE: Switches U5, U14 and U15 are physically present on the CNA board but are inactive in this application.



ATTENTION: Certain procedures in this manual require that the Drive "Not be running". This assumes that the main contactor is de-energized and that the user has properly set up the interface logic to meet this criteria.

LED Indicators

The CNA board contains several LED's used to provide status information. LED DS1 indicates whether the CNA board itself is

faulted or not faulted. LED's DS2 and DS3 duplicate the function provided by the LED's on the Interface Plug. LED DS4 is inactive in this application. Tables 2.A and 2.B provide information on LED's DS1-DS3.

Table 2.A.
LED Indicator Status for Board

	LED	State	Function
CNA Board Status	DS1	LED Green – Blinking at 1 Hz	Normal Adapter Operation
		LED Green – Blinking Rapidly	Adapter is Faulted
		LED Off	Adapter Non-Operational

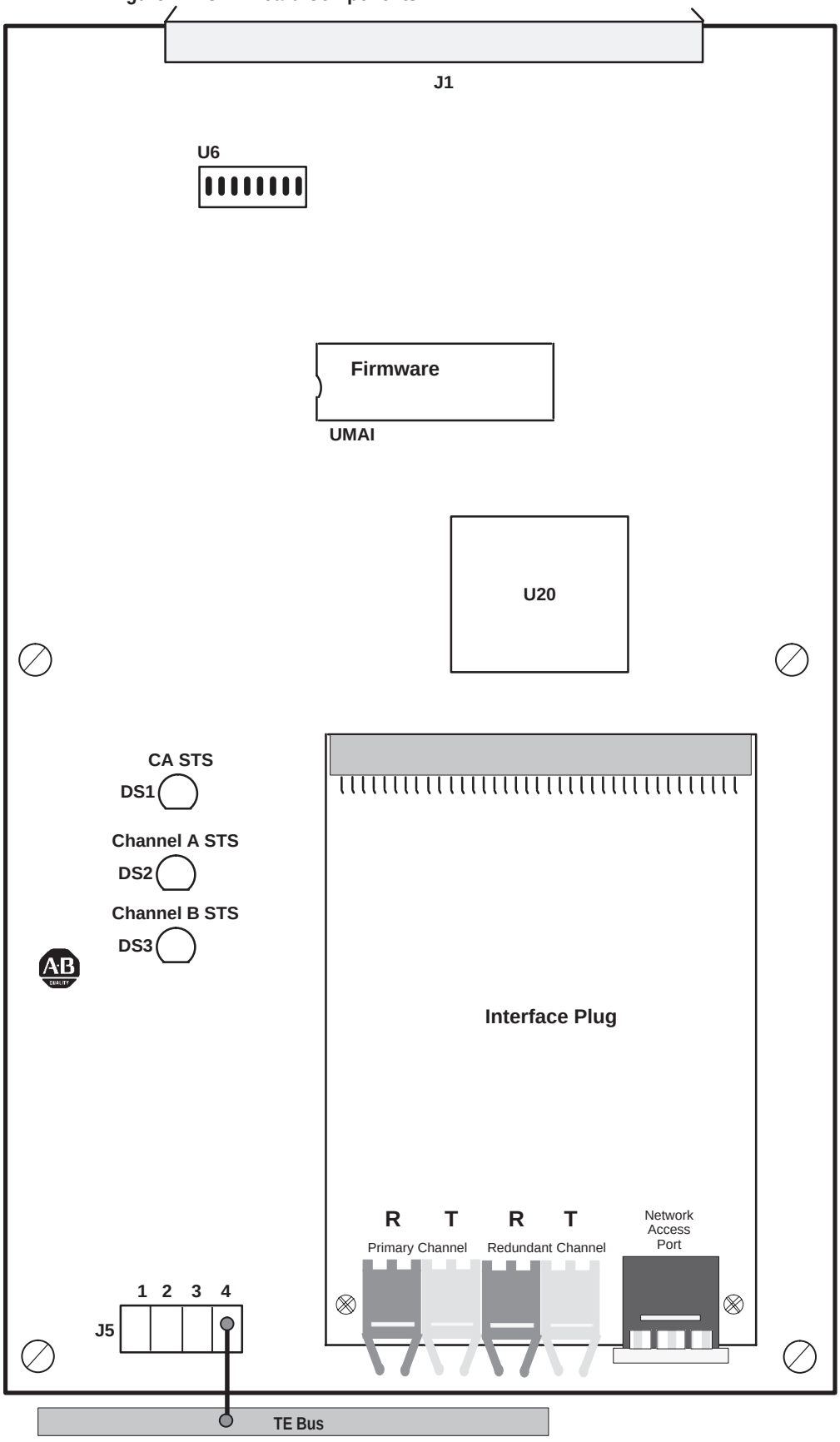
Table 2.B.
LED Indicator Status

Viewing LEDs DS2 & DS3:	If:	Then, this condition indicates
Together	Both LEDs are steady OFF	No Power, or reset condition exists
	Both steady RED	Failed link interface.
	Both steady GREEN	Normal Operation for redundant mode
	Alternating RED/GREEN	Self Test
	Alternating RED/OFF	Bad node configuration
Independently	One Channel LED is steady OFF	Channel disabled or not supported
	One Channel LED is flashing RED/GREEN	Invalid link interface
	One channel LED is flashing RED/OFF	Link Fault
	One channel LED is flashing GREEN/OFF	Channel in listening mode, or temporary channel error exists
	One channel LED is steady GREEN	Normal operation

Firmware Location

The CNA Board contains a microprocessor (U20) which is responsible for controlling all board functions and features. This board contains firmware version 1.xx (the "xx" designator may vary but does not affect information in this manual). Figure 2.1 shows the physical location of the firmware chip (UMA1). The setup and configuration data for the Adapter board is stored in the EEPROM memory located on the main control board of the Drive.

Figure 2.1. CNA Board Components



DIP Switch Orientation

DIP Switch orientation (Figure 2.2) on the CNA board is as Follows:

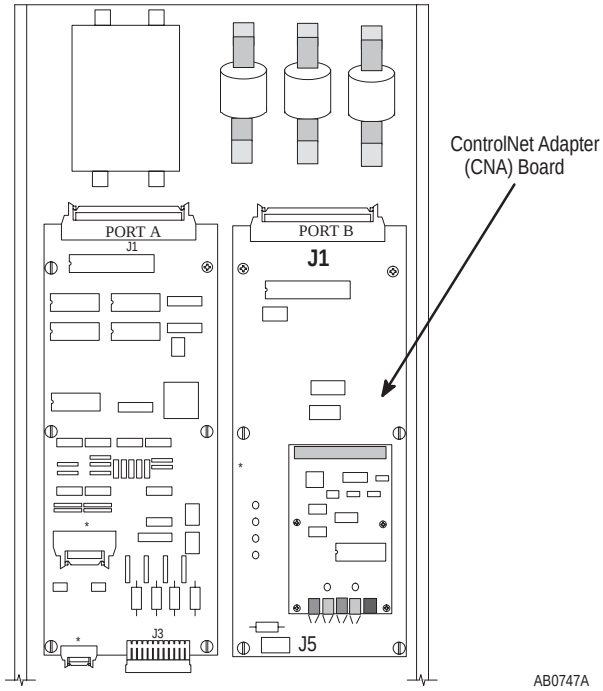
CLOSED = “ON” = “1”
OPEN= “OFF” = “0”

Figure 2.2. DIP Switch Orientation

Board Location

The standard mounting position for the CNA board is Port B of the Drive (Refer to Figure 2.3). If required, the Adapter can be mounted in Port A. Note that each port uses different parameters to store Adapter setup and configuration information.

Figure 2.3. CNA Board Mounted in Port B



Configuration & PLC Interfacing

Chapter Objective

This chapter contains a general description of the CNA Board's features and functions. It is intended to provide background information to support other procedures in this manual and help you to:

- Configure the Drive for use with the ControlNet Adapter Board
- Interface the Drive with an Allen-Bradley PLC Controller.

This chapter is not intended to be an all encompassing technical description of the CNA Board.

This chapter will provide a functional overview of each interface provided on the CNA board. Later chapters will describe in detail how to properly connect, configure, and use these interfaces.

Terminology

A brief description of terms and concepts covered in this chapter are:

Channel – Refers to a serial communication link.

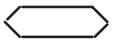
Configuration – The process of linking sink to source parameters for the purpose of distributing data within the Drive or adapter(s). Fast parameters are those which are updated rapidly. They are typically used for transmitting real time data to and from the Drive. Fast parameter values are not stored in non-volatile memory. Actual armature current is an example of a fast parameter.

ControlNet Network – A communication architecture that allows the exchange of data between Allen-Bradley Company, Inc. products and certified third party products.

Port – A physical location on the Drive reserved for the connection of Adapter cards. Each Drive has two ports. The ports are identified in firmware as "Port A" and "Port B".

Parameter – A memory location in the Drive or Adapter used to store data. This data can be real time data and/or setup information. Each parameter has an assigned number and function. Parameters are displayed in engineering units when viewed from program terminals.

Parameter Table – A table which contains all parameters that are available in the Drive and adapters.

Source Parameter –  A parameter that contains real time information that is available for use by other devices. These devices can include PLC controllers, operator interface devices, program terminals, etc.

Sink Parameter – Sink parameters accept data from other parameters which is then used by the Drive to perform the desired functions. An example of a sink is the external velocity reference parameter which accepts a speed reference from a device such as a PLC.

Scheduled Transfer – Deterministic and repeatable transfers that are continuous and asynchronous to the ladder-logic program scan.

Unscheduled Transfer – Non-deterministic data transfers through ladder-initiated communication or programming devices.

Operation

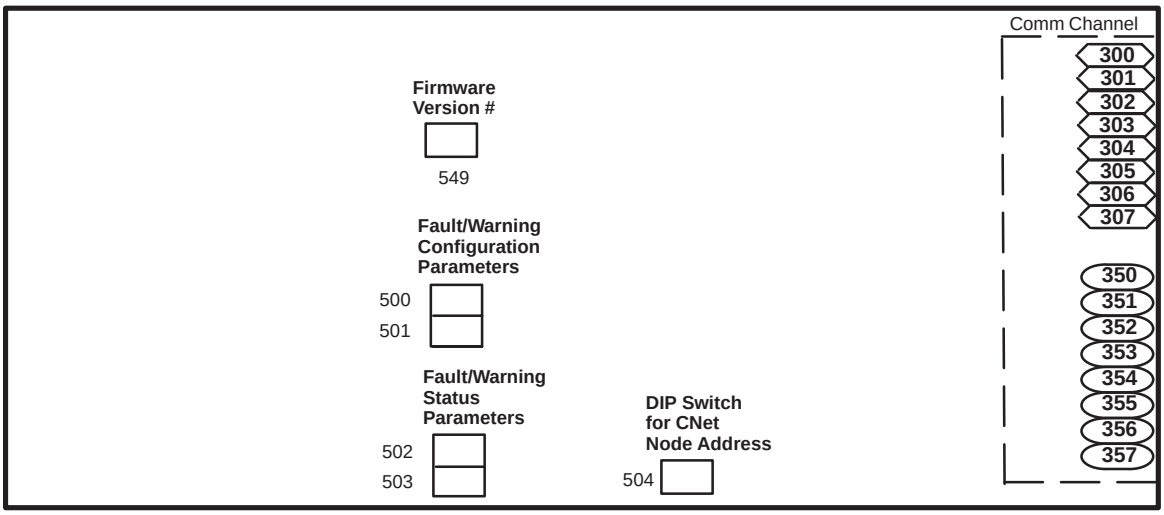
The primary purpose of the CNA board is to allow the 1395 Drive to be directly controlled by a PLC via ControlNet. This adapter has one Digital communication channel with a redundant connector to allow for backup communication to the PLC.

All scheduled data transfers between the PLC and the 1395 Drive must be configured on a ControlNet network. You must specify where I/O data is to be read from or written to when establishing the relationship between processors, I/O adapters and data table file addresses.

ATTENTION: When configuring this drive on a ControlNet network, you must request a Network Update Time (NUT) of 5ms or greater. A NUT less than 5ms may cause data transfers to (and from) the drive to become non–deterministic.

Figure 3.1 presents an overview of the CNA board with a typical Channel configuration. The parameter numbers shown are for a CNA board mounted in Port B of the Drive. This is the standard Port for the CNA Board.

Figure 3.1. CNA Board Channel Configuration for Port B



Communications

When you use the ControlNet Adapter Board for ControlNet communications, the drive looks like a remote I/O chassis to a PLC. This allows you to use discrete data transfer.

With discrete data transfer, the PLC controller's I/O image table is used to transfer the data that the drive needs to have continuously updated

ControlNet has the option for redundancy. Redundancy for the entire network is determined by the configuration tool (RS Networx™).

Below is a listing of the CNA features on this Adapter:

- The board can be configured as a full I/O rack only.
- The board can be configured to ignore PLC fault conditions and continue Drive operation.

ATTENTION: Configuring the board to ignore PLC fault conditions could lead to erratic operation and possible Drive or equipment damage.

- The messaging mechanism can support transfer of multiple Drive parameters (up to 5) in a single request.
- A "redundant" feature allows the Drive to be connected to a redundant network

General

The CNA board does not scale or manipulate data that is transferred between the Drive and PLC Controller. If data in the PLC is manipulated in units other than Drive units, the data must first be converted to Drive Units before being sent to the Drive. Consequently, all scaling of data must be performed in the PLC.

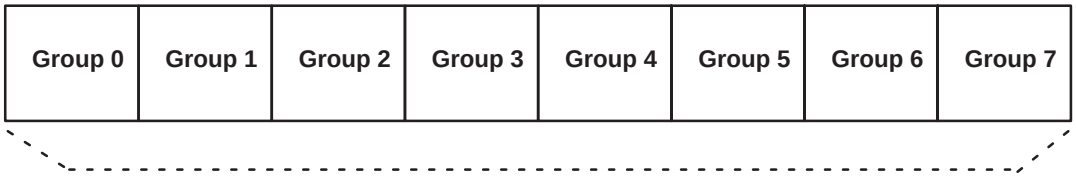
To control Drive parameters the CNA parameters are linked to the Drive by using source and sink parameters. Refer to the Drive Installation and Maintenance manual for details on Drive configuration links.

Discrete PLC Controller I/O Data Transfer

Data required by the Drive on a continuously updated basis is transferred using the I/O image table of the PLC Controller. The data transfer rate can be determined using the standard conventions for I/O rack updates of discrete I/O. Refer to the PLC Controller manual for details.

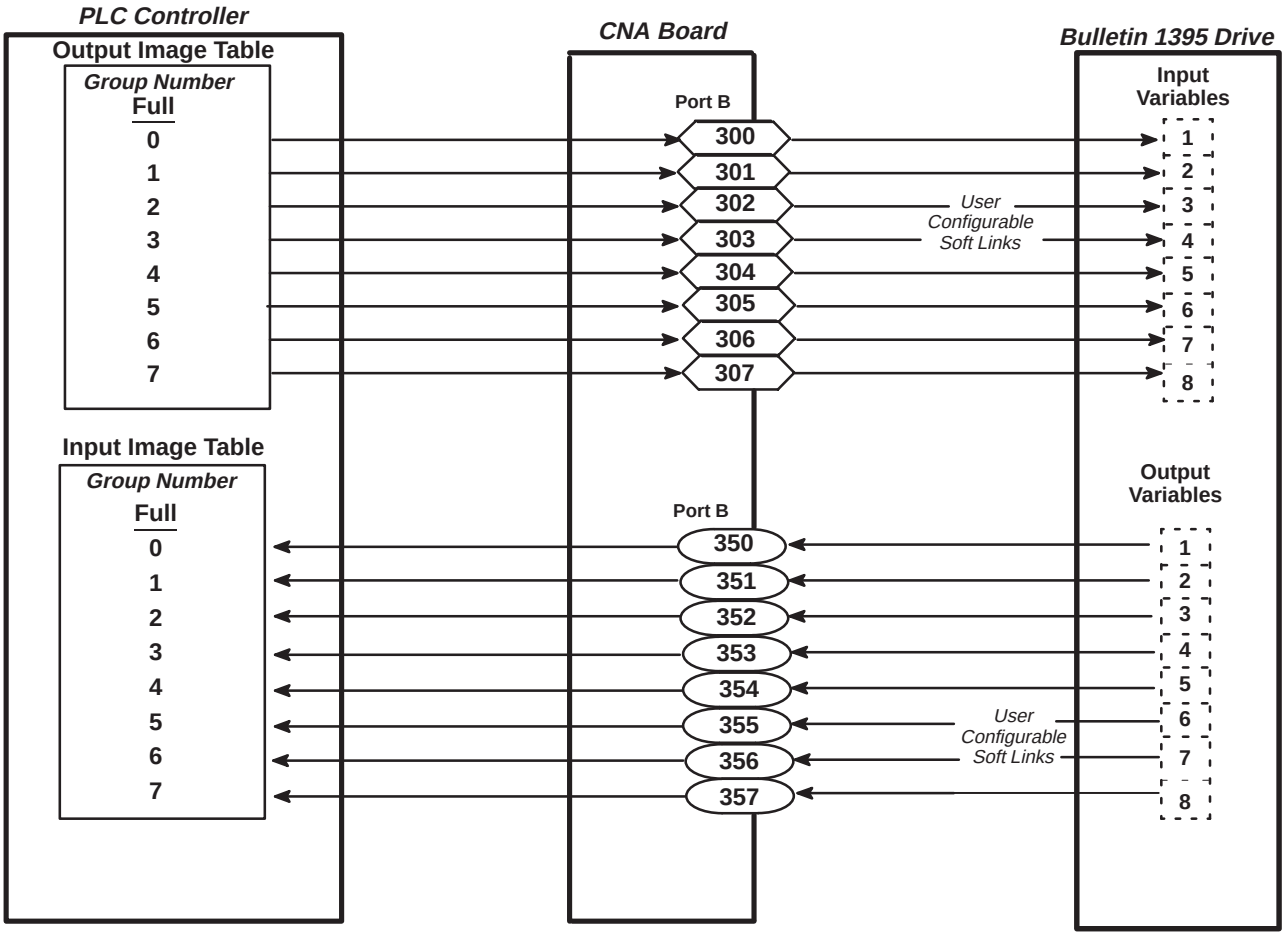
Refer to Figure 3.2. This figure indicates how data is transferred between the Drive and PLC controller. The group numbers (0-7) are used for the transfer of discrete type data. Each group number reserves a single 16 bit word in both the input and output image table of the PLC Controller for the rack number assigned. In the Drive these words are directly linked to internal Drive parameters using source and sink parameters as shown in Figure 3.3.

Figure 3.2. Full Rack Configuration



Groups 0-7 each appear (to the PLC Controller) to have a 16 bit input and output module installed.

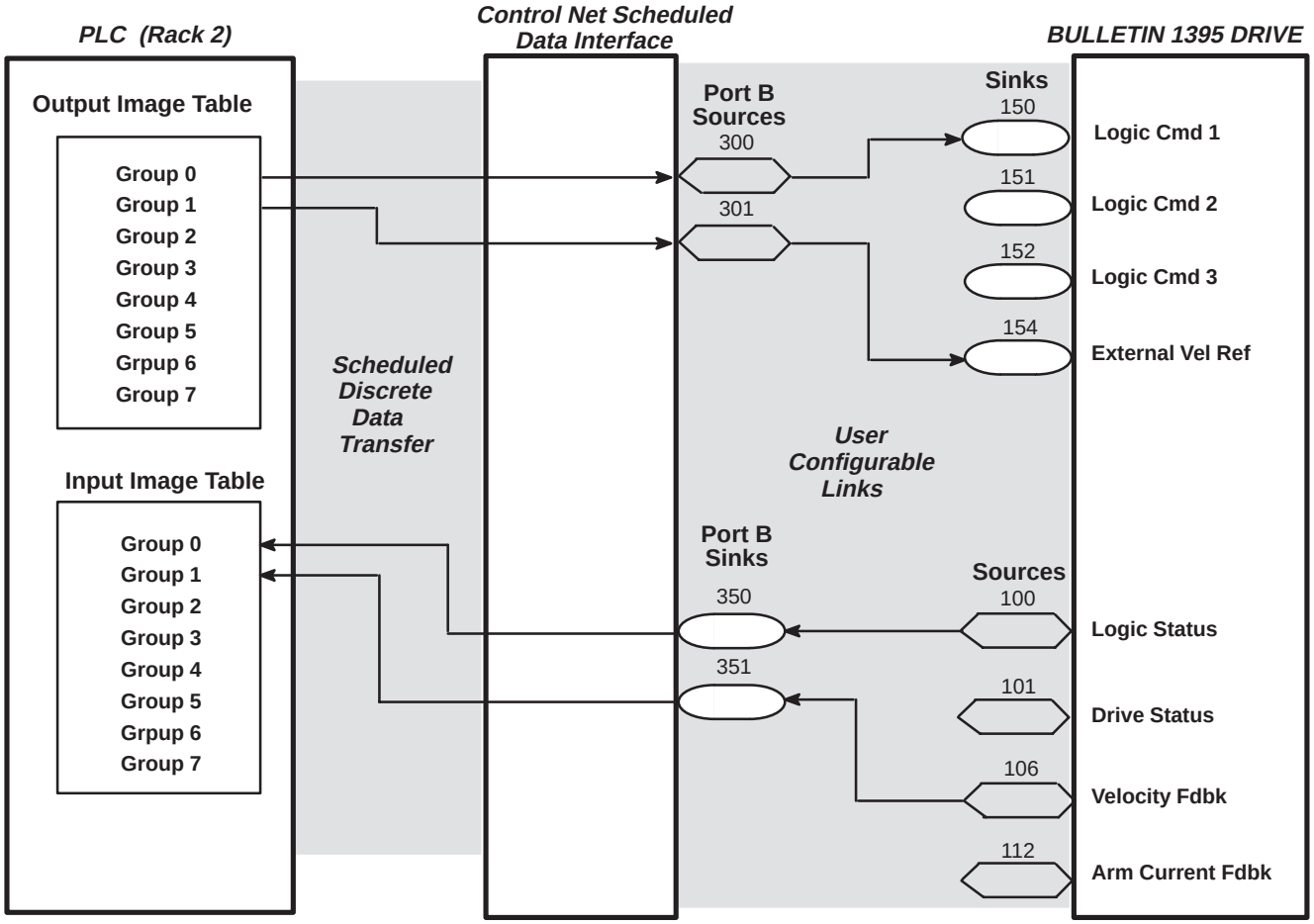
Figure 3.3. ControlNet Adapter Configuration Example



Discrete PLC Controller I/O Example

Figure 3.4 illustrates an application where the 6 bit words for group 1 and 2 are being used by the PLC Controller program for data transfer with the Drive. In this example, the Drive has been configured so that the data coming into source parameter 300 is sent to Logic Cmd 1 (parameter 150). Information sent to the Drive Using the 16 bit output word for group 1 of rack 2 must therefore be a 16 bit logic word where the bits are defined by the description of parameter 150.

Figure 3.4. Discrete PLC Controller I/O Example



In a similar manner, the External Velocity Ref (parameter 154) has been linked to source parameter 301. The 16 bit output word for group 2 of rack 2 must be a 16 bit signed integer whose value corresponds to the allowable values in Drive Units for parameter 154.

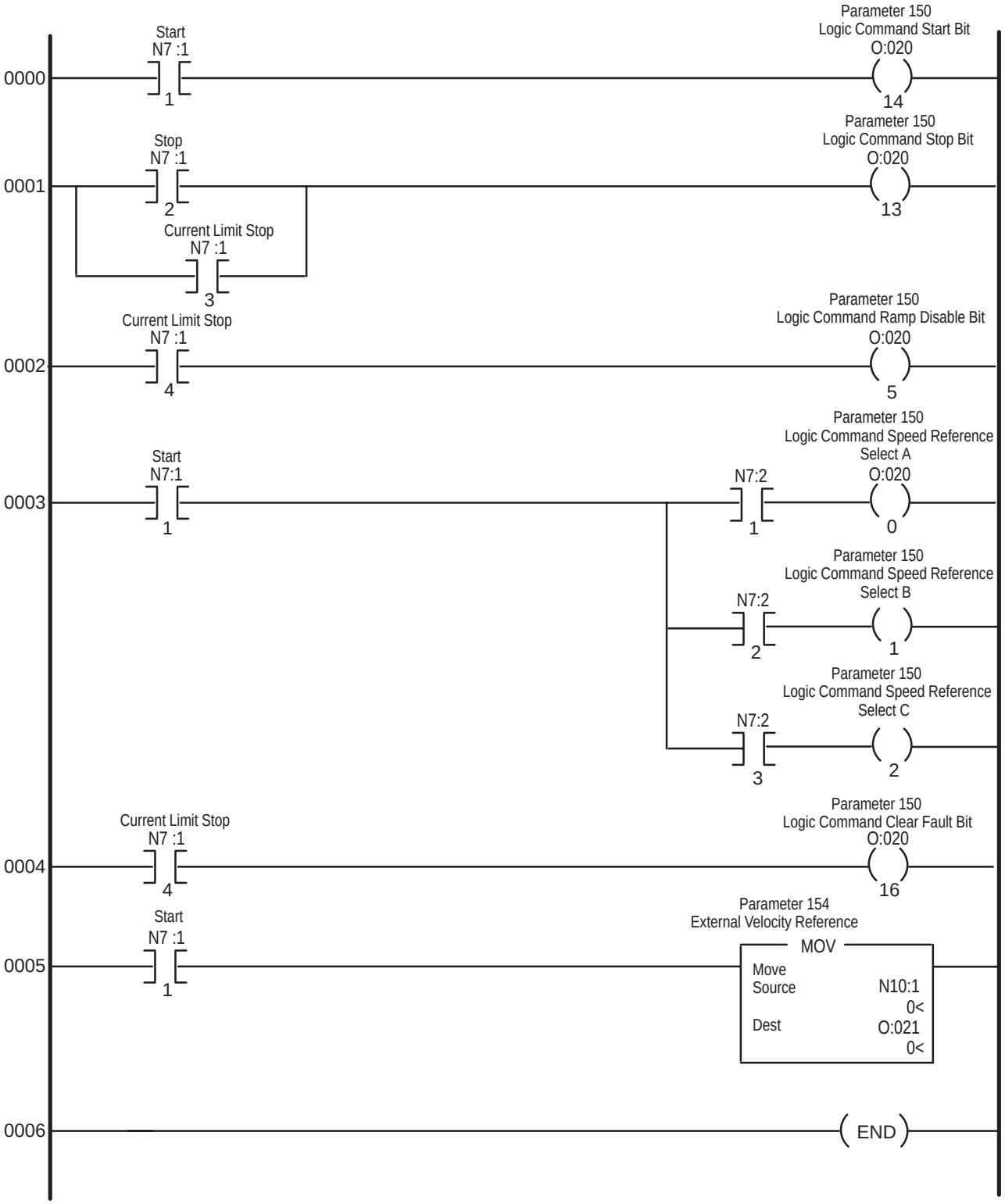
Information from the Drive consists of Logic Status (parameter 100) and Velocity Fdbk (parameter 106). Based on the links shown in Figure 3.2, the 16 bit input word for group 1, rack 2 in the PLC Controller is a 16 bit logic status word. The bits in this 16 bit word are defined by the description for parameter 100. In addition, the 16 bit input for group 2, rack 2 in the PLC Controller is a 16 bit signed

integer whose value corresponds to the allowable values in Drive Units for parameter 106.

If the data transferred between the Drive and PLC Controller will be manipulated (in the PLC Controller) in units other than Drive Units, the PLC Controller program must scale the information. The scaled information must be based on the Drive Units definitions for the parameters in the Drive. The External Vel Ref (parameter 154) is in Drive units where 4096 is defined as base speed. If the PLC Controller program is written in terms of feet per minute (FPM), then FPM must be converted to Drive Units before being sent to the Drive.

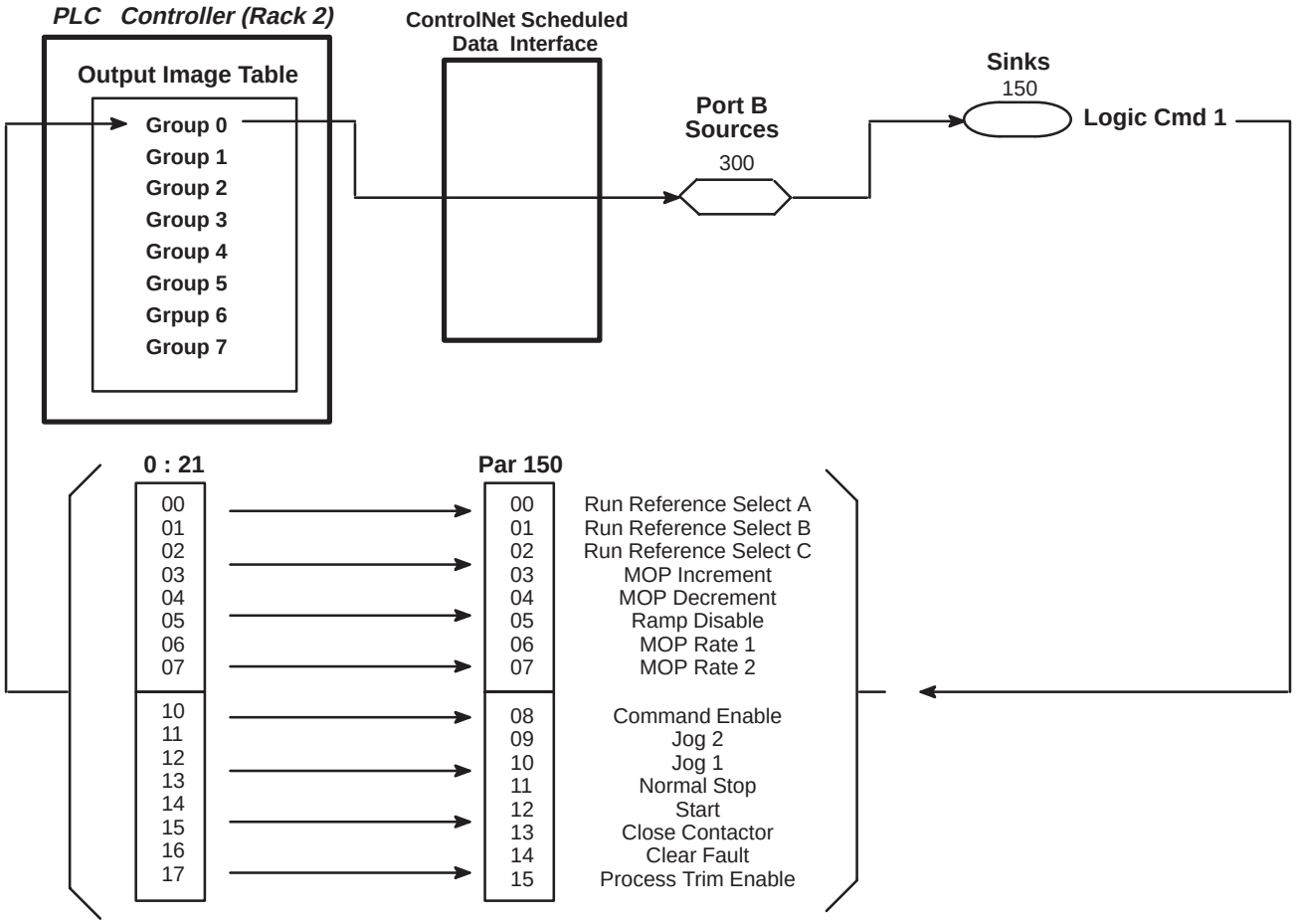
Figure 3.5 provides an example PLC Controller program which could be used to control the Drive. Based on the configuration shown in Figure 3.4 the PLC Controller program will be transferring information to parameter 150 and 154 in the Drive. Integer file N7 in the PLC is being used for Drive logic control and integer file N10 word 01 is used to store the Drive speed reference. To control the logic operation of the Drive, the PLC program must control the bits in the output image table which correspond to the desired operation. Because parameter 300 has been linked to parameter 150 (Figure 3.5), and parameter 300 is associated with group 1 in the output image table, the PLC Controller program will be controlling bits in word 0:20.

Figure 3.5. Example PLC Controller Discrete I/O Program



Bit numbering in the PLC Controller is performed in Octal, as opposed to Decimal numbering in the Drive parameter 150, so it is necessary to relate the output image table bits to the controlled bits in parameter 150. Figure 3.6 shows the correlation between the output image table bits and the Drive parameter 150 bits. As a result of this relationship, if it is desired to set the start bit in parameter 150 (bit 12 decimal), then bit 021/14 must be set as shown in the first rung of Figure 3.5. Control of other logic bits is illustrated in Figure 3.5.

Figure 3.6. Bit Mapping for Logic Command (P150, 151, 152)



The first 3 bits of the Logic Command word (parameter 150 in this example), are used to determine which speed reference will be used by the Drive. If the normal run speed reference input to parameter 154 is to be used, all three bits must be 0. If a preset speed or the MOP function will be used, bits 0–2 are set accordingly (refer to Bulletin 1395 Installation and Maintenance manual for a complete description of the Logic Command bits). In this example, the first three bits of word 2 of integer file N7 are used to determine the speed reference used by the Drive as shown on rung 4 in Figure 3.5.

If the normal run speed reference is selected, the PLC Controller must send a 16 bit word to External Vel Ref (parm 154) in the Drive. Because the speed reference is a complete 16 bit word, the PLC Controller must send the data as a complete word rather than as individual bits as was the case for logic command bits. In this example, word 1 of integer file N10

is used to store the speed reference for the Drive. The MOV block in rung 6 of Figure 3.5 transfers the 16 bit word of N10:01 to word 2 of the output image table. Because word 2 of the output image table is sent to parameter 301, which in turn is linked to parameter 154 (Figure 3.4), the 16 bit word N10:01 is the speed reference input to the Drive param. 154.

Information transferred back to the PLC Controller from the Drive is handled much as it was in the previous example, with the exception that data is transferred from the input image table of the PLC Controller to the working data files in the PLC Controller program. Again, note that bit coded words such as Logic Status (parm 100), are bit numbered in Octal in the PLC Controller, while the Drive is in Decimal.

Command Set

The CNA board supports a limited set of PCCC commands by emulating a section of PLC-5 memory. The memory area emulated determines what specific request and or action the CNA board will take. Below is a list of the supported commands:

NOTE: A maximum of 5 parameters can be obtained with each transaction.

Who Active – The node address of the CNA board (as defined by it's DIP switch settings) will be displayed on the "Who Active" screen of the PLC software. It will read "1395 DRV" next to the selected station.

PLC 5 Typed Read (N10:0-999) – Memory area N10:0-999 translates into a read parameter value(s) from the Drive. Any attempts to read outside of this range will result in an error response. The values 0 through 999 are interpreted by the Drive as parameter numbers. For example, to read the value of parameter 633 the MSG instruction would request N10:633 with a size of one element. A size of 5 will read to parameters 633 through 637.

PLC 5 Typed Write (N10:500-999) – Memory area N10:500-999 translates into a write parameter value(s) to the Drive. Any attempts to write outside of this range will result in an error response. The values 500 through 999 are interpreted by the Drive as parameter numbers. For example, to write a value to Preset Speed 1 (parameter 633) the MSG instruction would specify N10:633 with a size of one element. A size of 5 will write to parameters 633 through 637.

PLC Typed Read (N20:499-999) – This request reads the status of the previous parameter writes (N20:500-999). If a **Typed Read** is specified with an PLC address of N20:499, the write status of all parameters from the last TYPED WRITE request (N10: xxx-xxx) will be OR'ed together. If one error has occurred during the last write operation, this address will contain the parameter number where the error occurred. If multiple errors occurred the value will be 0FFFF (hex), and the PLC Controller can request a **Typed Read** of N20:500-999 to determine which parameters have had errors.

PLC Typed Read (N30:0-999) - This request translates into a read parameter full message in the Drive. Each parameter specified results in 13 words of data (actual value, minimum value, maximum value, descriptor, and parameter text). You can read a maximum of 5 parameters with this service.

PLC Typed Read (N40:0-39) - This message emulates the RIO block transfer functions available on the CNA board with the exception of the multiple parameter read. Refer to the message structure section of this chapter for details on the available messages and their use.

NOTE: With this command there are no BT flags to synchronize the Write/Read operation as on the RIO.

PLC Typed Write (N40:0-39) - This message emulates the RIO block transfer functions available on the MCA board with the exception of the multiple parameter write. Refer to the message structure section of this chapter for details on the available messages and their use.

NOTE: With this command there are no BT flags to synchronize the Write/Read operation as on the RIO.

PLC Typed Read
(N70:0-119) for Trend 1
(N71:0-119) for Trend 2
(N72:0-119) for Trend 3
(N73:0-119) for Trend 4 - This message reads the trend sampled data, which is the data retained when a trigger condition occurs. A file of 70 corresponds to Trend 1, 71 to Trend 2, 72 to Trend 3, and 73 to Trend 4.

Message Formats

This section of the manual provides a detailed explanation of the messages that the Drive supports. These messages are used by ControlNet to program Drive parameters, read parameter data, and control other Drive functions.

The following table summarizes the valid function code that is displayed in word 3 of the PLC message write header message. A complete description of the messaging write header is provided on the specified page.

Function:	Function Code:	Page:
EE Memory Recall	257	3-13
EE Memory Store	513	3-14
EE Memory Initalize	769	3-15
Read Parameter Data	514	3-16
Read Parameter Full	770	3-18
Write Parameter Data	515	3-20
Read System Clock	1026	3-22
Write System Clock	1027	3-23
Drive System Reset	1539	3-24
Clear Faults	1795	3-25
Autotune Measure Motor Inertia	269	3-26
Autotune Update Motor Inertia	525	3-27
Autotune Measure System Inertia	781	3-28
Autotune Update System Inertia	1037	3-29
Autotune Tune Velocity Loop	1037	3-30
Autotune Update Velocity Tune	1293	3-31
Read Trend Information	1549	3-32
Message Operation	270	3-34

Upload Configuration Link

This function uploads the configuration table information from the Drive in blocks. Each block of configuration data has a separate function code.

PLC Block Transfer Instruction Data –

	Write	Read
Size In Elements:	4	4
Processor Type:	PLC-5	PLC-5
Destination Address:	N15:0-3	N15:0-23

Message Structure –

PLC Message Write

0	Header Word 1
0	Header Word 2
Function Code see table	Header Word 3
8	Header Word 4

PLC Message Read

0	Header Word 1
0	Header Word 2
See Table	Header Word 3
48	Header Word 4
Parameter # (X50)	Header Word 5
Parameter # (X51)	Header Word 5
Parameter # (X52)	Header Word 6
.	.
Parameter # (X69)	Header Word 23

NOTE: Word 4 of the PLC Message Read instruction is broken down into two bytes. The High byte contains the status bits The Low byte contains the Drive message length in bytes.

The “x” designator is a position holder. It could represent parameter 150, 250, 350, etc. depending on which configura tion table is being requested.

Upload Function Codes

Parameter Numbers	Function Code
#50 – #69	260
#150 – #169	516
#250 – #269	772
#350 – #369	1028
#450 – #469	1284

Message Operation – The UPLOAD CONFIGURATION LINKS function requests a listing of the Drive configuration links from the Drive for use in the PLC Controller. This command is broken down into five groups of tables.

Download Configuration Link

This function downloads the configuration table information from the Drive in blocks. Each block of configuration data has a separate function code.

PLC Block Transfer Instruction Data –

	Write	**Read**
Size In Elements:	24	4
Processor Type:	PLC-5	PLC-5
Destination Address:	N15:0-23	N15:0-3

Message Structure –

PLC Message Write

0	Header Word 1
0	Header Word 2
See Table	Header Word 3
48	Header Word 4
Parameter # (X50)	Header Word 5
Parameter # (X51)	Header Word 5
Parameter # (X52)	Header Word 6
.	.
Parameter # (X69)	Header Word 23

PLC Message Read

0	Header Word 1
0	Header Word 2
Function Code see table	Header Word 3
8	Header Word 4

NOTE: Word 4 of the PLC Message Read instruction is broken down into two bytes. The High byte contains the status bits The Low byte contains the Drive message length in bytes.

The “x” designator is a position holder. It could represent parameter 150, 250, 350, etc. depending on which configura tion table is being requested.

Upload Function Codes

Parameter Numbers	**Function Code**
#50 – #69	1540
#150 – #169	1796
#250 – #269	2052
#350 – #369	2308
#450 – #469	2564

Message Operation – The DOWNLOAD CONFIGURATION LINKS function sends a listing of the desired Drive configuration links to the drive. This command is broken down into five groups of tables.

IMPORTANT: Drive configuration links will not be changed by the Drive unless the following two conditions are met:

1. The Drive must not be running (i.e. the DC loop contactor must not be energized).
2. The Drive receives the fifth block (function code 2564) of links.

NOTE: You must download all five groups in order for the links to take effect.

EE Memory Recall

This function takes the information stored in the Drive's EEPROM memory and places it in Drive memory.

ATTENTION: All data that was stored in Drive memory prior to issuing the EE RECALL command will be erased when an EE RECALL takes place.

PLC Block Transfer Instruction Data –

	Write	Read
Size In Elements:	4	4
Processor Type:	PLC-5	PLC-5
Destination Address:	N40:0-3	N40:0-3

Message Structure –

PLC Message Write

0	Header Word 1
0	Header Word 2
Function Code 257	Header Word 3
Message Length 8 bytes	Header Word 4

PLC Message Read

0	Header Word 1
0	Header Word 2
Function Code 257	Header Word 3
See Note	Header Word 4

NOTE: Word 4 of the PLC Message Read instruction is broken down into two bytes. The High byte contains the status bits The Low byte contains the Drive message length in bytes.

Message Operation – The EE Memory Recall function instructs the Drive to replace the contents of Drive memory with the values that are stored in EEPROM. Any configuration links present in the Drive will also be replaced by those in EEPROM.

IMPORTANT: This message is ignored by the Drive when it is running (i.e. the contactor is picked up).

This function requires the message header only. The status byte will indicate the success or failure of the request.

EE Memory Store

This function takes the information in the Drive's memory and places it in the EEPROM. Any data in the EEPROM prior to issuing the EEPROM STORE command will be erased.

PLC Block Transfer Instruction Data –

	Write	Read
Size In Elements:	4	4
Processor Type:	PLC–5	PLC–5
Destination Address:	N40:0–3	N40:0–3

Message Structure –

PLC Message Write

0	Header Word 1
0	Header Word 2
Function Code 513	Header Word 3
Message Length 8 bytes	Header Word 4

PLC Message Read

0	Header Word 1
0	Header Word 2
Function Code 513	Header Word 3
See Note	Header Word 4

NOTE: Word 4 of the PLC Message Read instruction is broken down into two bytes. The High byte contains the status bits The Low byte contains the Drive message length in bytes.

Message Operation – The EE Memory Store function instructs the Drive to replace the contents of the Drive EEPROM with the values that are stored in Drive memory. Any configuration links present will also be replaced by those in memory. Depending on the Drive firmware version, this message may be ignored by the Drive when it is running (i.e. the contactor is picked up).

ATTENTION: When using the EE Memory Store function you must be certain that the values stored in Drive memory will not degrade Drive or System performance and will not cause a loss of either control or emergency stop functions.

This function requires the message header only. The status byte will indicate the success or failure of the request.

EE Memory Initialize

This function initializes the Drive's memory and EEPROM to a set of default values stored internally in the Drive.

IMPORTANT: Any data in Drive memory and EEPROM prior to issuing the EEPROM INITIALIZE command will be erased.

PLC Block Transfer Instruction Data –

	Write	**Read**
Size In Elements:	4	4
Processor Type:	PLC-5	PLC-5
Destination Address:	N40:0-3	N40:0-3

Message Structure –

PLC Message Write

0	Header Word 1
0	Header Word 2
Function Code 769	Header Word 3
Message Length 8 bytes	Header Word 4

PLC Message Read

0	Header Word 1
0	Header Word 2
Function Code 769	Header Word 3
See Note	Header Word 4

NOTE: Word 4 of the PLC Message Read instruction is broken down into two bytes. The High byte contains the status bits The Low byte contains the Drive message length in bytes.

Message Operation – The EE Memory Recall function instructs the Drive to replace the contents of Drive memory with the values that are stored in EEPROM. Any configuration links present in the Drive will also be replaced by those in EEPROM. This message is ignored by the Drive when it is running (i.e. the contactor is picked up).

ATTENTION: When using the EE Memory Recall function you must be certain that the default values stored in the Drive will not degrade Drive or System performance and will not cause a loss of either control or emergency stop functions.

This function requires the message header only. The status byte will indicate the success or failure of the request.

Read Parameter Data

This function reads a parameter value from the Drive based on a parameter number list provided by the PLC Program.

PLC Block Transfer Instruction Data –

	Write	**Read**
Size In Elements:	5	6
Processor Type:	PLC-5	PLC-5
Destination Address:	N40:0-4	N40:0-5

Message Structure –

PLC Message Write

0	Header Word 1
0	Header Word 2
Function Code 514	Header Word 3
Message Length See Examples	Header Word 4
Parameter #	Data Word 5

PLC Message Read

0	Header Word 1
0	Header Word 2
Function Code 514	Header Word 3
See Note	Header Word 4
Parameter #	Data Word 5

NOTE: Word 4 of the PLC Message Read instruction is broken down into two bytes. The High byte contains the status bits The Low byte contains the Drive message length in bytes.

Message Operation – The READ PARAMETER DATA function requests the Drive to provides a parameter data value for use in the PLC Controller. The value is returned in Drive units and may need to be scaled by the PLC Controller prior to being used in the Program.

The PMW length is determined by adding the message header length (4 words) to the number of words required to specify the parameter list. Each parameter requested requires two words in the PMW instruction with the exception of the last parameter in the list. The last parameter requires only one word. Below is an example:

Example 1:
The PLC Controller is to read 1 parameter value from the Drive.

	PMW	PMR	Message Header for BTW Word 3
Message Header 8 bytes		4	4
Parameter Data	1	2	2 bytes
Total 10 bytes		5 words	6 words

Read Parameter Full (Value, Min, Max, Descriptor, Text)

This function reads the full parameter description from the Drive based on a parameter number provided by the PLC Program. The description includes the actual value, minimum value, maximum value, descriptor, and the parameter text.

PLC Block Transfer Instruction Data –

	Write	Read
Size In Elements:	5	25
Processor Type:	PLC–5	PLC–5
Destination Address:	N40:0–4	N40:0–24

Message Structure –

PLC Message Write

0	Header Word 1
0	Header Word 2
Function Code 770	Header Word 3
Message Length 10 bytes	Header Word 4
Parameter #	Data Word 5

PLC Message Read

0	Header Word 1
0	Header Word 2
Function Code 770	Header Word 3
See Note	Header Word 4
Parameter #	Data Word 5
Parameter Data	Data Word 6
Minimum Value	Data Word 7
Maximum Value	Data Word 8
Descriptor	Data Word 9
Parameter Text	Data Word 10
–	–
Parameter Text	Data Word 17

NOTE: Word 4 of the PLC Message Read instruction is broken down into two bytes. The High byte contains the status bits The Low byte contains the Drive message length in bytes.

Message Operation – The READ PARAMETER FULL function requests the Drive to provide the full description of a parameter for use in the PLC Controller. This information includes the actual value, minimum value, maximum value, descriptor, and the parameter text.

Data Format:

Parameter Value – Drive units, may need to be scaled by the Controller prior to being used in the Program.

Maximum Value – Drive units, may need to be scaled by the PLC Controller prior to being used in the Program.

Minimum Value – Drive units, may need to be scaled by the PLC Controller prior to being used in the Program.

Descriptor – A numeric value used by Allen-Bradley program terminals to scale parameter data into the appropriate engineering units.

Parameter Text – The parameter text is provided in the following format. Each parameter text word contains two bytes in ASCII format, which represent the text displayed by the Drive's program terminals.

NOTE: Any parameter text that is returned comes back with each byte reversed.

Write Parameter Data

This function writes a parameter value to the Drive.

PLC Block Transfer Instruction Data –

	Write	Read
Size In Elements:	6	6
Processor Type:	PLC–5	PLC–5
Destination Address:	N40:0–5	N40:0–5

Message Structure –

PLC Message Write

0	Header Word 1
0	Header Word 2
Function Code 515	Header Word 3
Message Length See Examples	Header Word 4
Parameter #	Data Word 5
Parameter Data	Data Word 6

PLC Message Read

0	Header Word 1
0	Header Word 2
Function Code 515	Header Word 3
See Note	Header Word 4
Parameter #	Data Word 5
Parameter Status	Data Word 6

NOTE: Word 4 of the PLC Message Read instruction is broken down into two bytes. The High byte contains the status bits The Low byte contains the Drive message length in bytes.

Message Operation – The WRITE PARAMETER DATA function requests the Drive to change the value of a parameter specified in the message to the value contained in the message. The value must be sent to the Drive in Drive units and may need to be scaled by the PLC Controller prior to being sent.

The PMW length is determined by adding the message header length (4 words) to the number of words required to specify the parameter list and data. Parameter and data change requires two words in the PMW instruction. Below is an example:

Example 1:

The PLC Controller is to read 1 parameter value from the Drive.

	PMW	PMR	Message Header Word 3
Message Header 8 bytes		4	4
Parameter Data	1	2	2 bytes
Total 10 bytes		5 words	6 words

The PMR message is structured the same as the PMW instruction with the exception that the Drive will provide a status word for the parameter. If the parameter value is accepted by the Drive, the status byte in word four will indicate that the message was successful. If the message status indicates an error, then the PLC Controller program must check the parameter status word to determine which parameter(s) was not accepted by the Drive.

Read System Clock

This function reads the system time from the Drive.

PLC Block Transfer Instruction Data –

	Write	Read
Size In Elements:	4	11
Processor Type:	PLC-5	PLC-5
Destination Address:	N40:0-4	N40:0-10

Message Structure –

Message Header Information:
Word 1: 0
Word 2: 0
Function Code, Word 3: 1026
Write Message Length, Word 4: 8 bytes

PLC Message Write

0	Header Word 1
0	Header Word 2
Function Code 1026	Header Word 3
Message Length 8 bytes	Header Word 4

PLC Message Read

0	Header Word 1
0	Header Word 2
Function Code 1026	Header Word 3
See Note	Header Word 4
Year	Data Word 5
Month (1–12)	Data Word 6
Day (1–31)	Data Word 7
Hour (0–24	Data Word 8
Minute (0–59	Data Word 9
Second (0–59)	Data Word 10
10's of msec (0–100)	Data Word 11

NOTE: Word 4 of the PLC Message Read instruction is broken down into two bytes. The High byte contains the status bits The Low byte contains the Drive message length in bytes.

Message Operation – The READ SYSTEM CLOCK function requests the Drive to provide its current time. The Drive stores time in the 24 hour format. The values returned are integer type and may be scaled by the PLC Controller prior to being used in the Program.

Write System Clock

This function writes the system time from the PLC Controller to the Drive.

PLC Block Transfer Instruction Data –

	Write	Read
Size In Elements:	10	4
Processor Type:	PLC	PLC-5
Destination Address:	N40:0-9	N40:0-9

Message Structure –

Message Header Information:
Word 1: 0
Word 2: 0
Function Code, Word 3: 1027
Write Message Length, Word 4: 20 bytes

PLC Message Write

0	Header Word 1
0	Header Word 2
Function Code 1027	Header Word 3
See Note	Header Word 4
Year	Data Word 5
Month (1–12)	Data Word 6
Day (1–31)	Data Word 7
Hour (0–24	Data Word 8
Minute (0–59	Data Word 9
Second (0–59)	Data Word 10

PLC Message Read

0	Header Word 1
0	Header Word 2
Function Code 1027	Header Word 3
See Note	Header Word 4

NOTE: Word 4 of the PLC Message Read instruction is broken down into two bytes. The High byte contains the status bits. The Low byte contains the Drive message length in bytes.

Message Operation – The WRITE SYSTEM CLOCK function sets the time in the Drive from the PLC Controller. The Drive stores time in the 24 hour format. The values are integer type and may need to be scaled by the PLC Controller prior to being sent to the Drive.

Drive System Reset

This function causes the Drive to do a “warm boot restart”. Any data in Drive memory at the time the command is issued is erased and is not saved in EEPROM.

PLC Block Transfer Instruction Data –

	Write
Size In Elements:	4
Processor Type:	PLC-5
Destination Address:	N40:0-3

Message Structure –

PLC Message Write

0	Header Word 1
0	Header Word 2
Function Code 1539	Header Word 3
Message Length 8 bytes	Header Word 4

Message Operation – The DRIVE SYSTEM RESET function causes the Drive to reboot all processors. This is the same sequence that the Drive goes through when power is first applied.

IMPORTANT: Any parameter data or configuration links that were not stored in EEPROM prior to the Drive receiving this command will be erased.

This function requires the message header only. The Drive will not provide a response message to this command.

Clear Faults

This function requests the Drive to clear any soft or warning faults that have occurred. It also clears the fault buffer. Hard faults cannot be cleared using the command.

PLC Block Transfer Instruction Data –

	Write	Read
Size In Elements:	4	4
Processor Type:	PLC-5	PLC-5
Destination Address:	N40:0-3	N40:0-3

Message Structure –

PLC Message Write

0	Header Word 1
0	Header Word 2
Function Code 1795	Header Word 3
Message Length 8 bytes	Header Word 4

PLC Message Read

0	Header Word 1
0	Header Word 2
Function Code 1795	Header Word 3
See Note	Header Word 4

NOTE: Word 4 of the PLC Message Read instruction is broken down into two bytes. The High byte contains the status bits The Low byte contains the Drive message length in bytes.

Message Operation – This function requests the Drive to clear any soft or warning faults that have occurred. It also clears the fault buffer. Hard faults cannot be cleared using this command.

IMPORTANT: If the Drive is running (i.e. the DC loop contactor is picked up), the CLEAR FAULTS command will be ignored.

Autotune Measure Motor Inertia

Puts the Drive in the Autotune Mode for measuring motor inertia. When in this mode the Drive gathers information about motor inertia by accelerating and decelerating the motor under conditions controlled by the Autotune firmware.

ATTENTION: When in the Autotune Mode the Drive controls motor operation using a speed profile determined internally. Carefully read the section on auto tuning sequencing prior to using this command. Failure to do so could result in equipment damage and possible injury to personnel. If autotuning is performed under PLC control, a hardwired stop circuit or manual disconnect circuit must be provided to disconnect power to the motor.

PLC Block Transfer Instruction Data –

	Write	**Read**
Size In Elements:	4	4
Processor Type:	PLC-5	PLC-5
Destination Address:	N40:0-3	N40:0-3

Message Structure –

PLC Message Write

0	Header Word 1
0	Header Word 2
Function Code 269	Header Word 3
Message Length 8 bytes	Header Word 4

PLC Message Read

0	Header Word 1
0	Header Word 2
Function Code 269	Header Word 3
See Note	Header Word 4

NOTE: Word 4 of the PLC Message Read instruction is broken down into two bytes. The High byte contains the status bits The Low byte contains the Drive message length in bytes.

Message Operation – This function puts the Drive in the Autotune Mode for measuring motor inertia. Once in this mode, the Drive waits for a “START” input to the Drive before beginning the measure procedure. The procedure gathers information about motor inertia by accelerating and decelerating the motor under conditions controlled by the Autotune firmware.

This function requires the message header only. The status byte will indicate the success or ineffectiveness of this request.

Autotune Update Motor Inertia

This function updates the Drives internal database with the motor inertia (parameter 613) calculated by the autotune firmware and provides the data to the PLC Controller.

PLC Block Transfer Instruction Data –

	Write	**Read**
Size In Elements:	4	6
Processor Type:	PLC-5	PLC-5
Destination Address:	N40:0-3	N40:0-5

Message Structure –

PLC Message Write

0	Header Word 1
0	Header Word 2
Function Code 525	Header Word 3
Message Length 8 bytes	Header Word 4

PLC Message Read

0	Header Word 1
0	Header Word 2
Function Code 525	Header Word 3
See Note	Header Word 4
Parameter 613	Data Word 5
Parameter Data	Data Word 6

NOTE: Word 4 of the PLC Message Read instruction is broken down into two bytes. The High byte contains the status bits The Low byte contains the Drive message length in bytes.

Message Operation – The AUTOTUNE UPDATE MOTOR VELOCITY function updates the Drives internal database with the motor inertia (parameter 613) calculated by the autotune firmware and provides the data to the PLC Controller.

Autotune Measure System Inertia

This function puts the Drive in the Autotune Mode for measuring system inertia. When in this mode the Drive determines the total system inertia including the motor and connected load by accelerating and decelerating the motor under conditions controlled by the Autotune firmware.

ATTENTION: When in the Autotune Mode the Drive controls motor operation using a speed profile determined internally. Carefully read the Drive Manual section on auto tuning sequencing prior to using this command. Failure to do so could result in equipment damage and possible injury to personnel. If autotuning is performed under PLC control, a hardwired stop circuit or manual disconnect circuit must be provided to disconnect power to the motor.

PLC Block Transfer Instruction Data –

	Write	**Read**
Size In Elements:	4	4
Processor Type:	PLC-5	PLC-5
Destination Address:	N40:0-3	N40:0-3

Message Structure –

PLC Message Write

0	Header Word 1
0	Header Word 2
Function Code 781	Header Word 3
Message Length 8 bytes	Header Word 4

PLC Message Read

0	Header Word 1
0	Header Word 2
Function Code 781	Header Word 3
See Note	Header Word 4

NOTE: Word 4 of the PLC Message Read instruction is broken down into two bytes. The High byte contains the status bits The Low byte contains the Drive message length in bytes.

Message Operation – This function puts the Drive in the Autotune Mode for measuring system inertia. Once in this mode, the Drive waits for a “START” input to the Drive before beginning the measure procedure. The procedure gathers information about motor inertia and connected load inertia by accelerating and decelerating the motor under conditions controlled by the Autotune firmware.

This function requires the message header only. The status byte will indicate the success or ineffectiveness of the request.

Autotune Update System Inertia

This function updates the Drives internal database with the system inertia (parameter 703) and the maximum achievable velocity loop bandwidth (parameter 701) as calculated by the auto tune firmware and provides the data to the PLC Controller in the PMR message.

PLC Block Transfer Instruction Data –

	Write	**Read**
Size In Elements:	4	8
Processor Type:	PLC-5	PLC-5
Destination Address:	N40:-3	N40:0-7

Message Structure –

Message Header Information:
Word 1: 0
Word 2: 0
Function Code, Word 3: 1037
Write Message Length, Word 4: 8 bytes

PLC Message Write

0	Header Word 1
0	Header Word 2
Function Code 1037	Header Word 3
Message Length 8 bytes	Header Word 4

PLC Message Read

0	Header Word 1
0	Header Word 2
Function Code 1037	Header Word 3
See Note	Header Word 4
Parameter 701	Data Word 5
Parameter Data	Data Word 6
Parameter 703	Data Word 7
Parameter Data	Data Word 8

NOTE: Word 4 of the PLC Message Read instruction is broken down into two bytes. The High byte contains the status bits The Low byte contains the Drive message length in bytes.

Message Operation – The AUTOTUNE UPDATE SYSTEM INERTIA function updates the Drives internal database with the system inertia (parameter #701) and maximum achievable bandwidth (Parameter #703) as calculated by the autotune firmware, and provides the data to the PLC Controller.

Autotune Tune Velocity Loop

This function calculates the required velocity loop gains based on the data determined by the motor inertia test, system inertia test, and damping factor (Parameter #702).

PLC Block Transfer Instruction Data –

	Write	**Read**
Size In Elements:	4	6
Processor Type:	PLC-5	PLC1-5
Destination Address:	N40:-3	N40:0-7

Message Structure –

PLC Message Write

0	Header Word 1
0	Header Word 2
Function Code 1037	Header Word 3
Message Length 8 bytes	Header Word 4

PLC Message Read

0	Header Word 1
0	Header Word 2
Function Code 1037	Header Word 3
See Note	Header Word 4
Parameter 702	Data Word 5
Parameter Data	Data Word 6

NOTE: Word 4 of the PLC Message Read instruction is broken down into two bytes. The High byte contains the status bits The Low byte contains the Drive message length in bytes.

Message Operation – The AUTOTUNE TUNE VELOCITY LOOP function calculates the Drives velocity loop parameters using the data determined by the motor inertia test, system inertia test, and the damping factor (Parameter #702).

Autotune Update Velocity Tune

This function updates the Drives internal database with the velocity loop parameters calculated by the Tune Velocity Loop function and provides the data to the PLC Controller.

PLC Block Transfer Instruction Data –

	Write	**Read**
Size In Elements:	4	4
Processor Type:	PLC-5	PLC-5
Destination Address:	N40:0-3	N40:0-3

Message Structure –

Message Header Information:
Word 1: 0
Word 2: 0
Function Code, Word 3: 1293
Write Message Length, Word 4: 8 bytes

PLC Message Write

0	Header Word 1
0	Header Word 2
Function Code 1293	Header Word 3
Message Length 8 bytes	Header Word 4

PLC Message Read

0	Header Word 1
0	Header Word 2
Function Code 1293	Header Word 3
See Note	Header Word 4

NOTE: Word 4 of the PLC Message Read instruction is broken down into two bytes. The High byte contains the status bits. The Low byte contains the Drive message length in bytes.

Message Operation – The AUTOTUNE UPDATE VELOCITY TUNE function updates the Drives internal data base with the Velocity loop Ki (parameter #659), velocity loop Kp (Parameter 660), and desired bandwidth (Parameter #700) as calculated by the autotune firmware, and provides the data to the PLC Controller in the PMR message.

Read Trend Information

This function reads the Trend information from the Drive. The Trend information is broken down into three separate blocks of data. Each block uses the same function code with the message specifing which block is to be read.

PLC Block Transfer Instruction Data –

	Write	**Read**
Size In Elements:	4	10
Processor Type:	PLC-5	PLC-5
Destination Address:	N40:0-3	N40:0-9

Message Structure –

Message Header Information:
Word 1: 0
Word 2: 0
Function Code, Word 3: 1549
Write Message Length, Word 4: 8 bytes

PLC Message Write

0	Header Word 1
0	Header Word 2
Function Code 1549	Header Word 3
Message Length 8 bytes	Header Word 4

PLC Message Read

0	Header Word 1
0	Header Word 2
Function Code 1549	Header Word 3
See Note	Header Word 4
Parameter #	Data Word 5
Parameter Data	Data Word 6
Parameter #	Data Word 7
Parameter Data	Data Word 8
Parameter #	Data Word 9
Parameter Data	Data Word 10

NOTE: Word 4 of the PLC Message Read instruction is broken down into two bytes. The High byte contains the status bits The Low byte contains the Drive message length in bytes.

Trend Number – This is an integer number used to specify which trend buffer the Drive will provide data for.

Trend Buffer #1 – 1
Trend Buffer #2 – 2
Trend Buffer #3 – 3
Trend Buffer #4 – 4

Block Number – This is an integer number used to specify which block of trend data (from the above specified trend buffer) the Drive is to supply. The definition of each block is as follows:

Block #0 – 0, Trend setup parameters
Block #1 – 1, Trend data samples 0 through 33
Block #2 – 2, Trend data samples 34 through 66
Block #3 – 3, Trend data samples 67 through 99

Message Operation

The READ TREND FILE function is used by a PLC Controller to get information about the Drive's trend buffers. This data includes both the setup information and the data samples for each buffer.

PLC Block Transfer Instruction Data –

	Write	**Read**
Size In Elements:	6	Refer to block information
Processor Type:	PLC-5	PLC-5
Destination Address:	N40:0-5	N40:0-18

Message Structure –

PLC Message Write

0	Header Word 1
0	Header Word 2
Function Code 270	Header Word 3
Message Length 12 bytes	Header Word 4
See Trend Number	Data Word 5
See Block Number	Data Word 6

PLC Message Read

0	Header Word 1
0	Header Word 2
Function Code 270	Header Word 3
See Note	Header Word 4
See Block Definition	Data Word 5
–	Data Word 6

NOTE: Word 4 of the PLC Message Read instruction is broken down into two bytes. The High byte contains the status bits The Low byte contains the Drive message length in bytes.

Refer to the Drive instruction manual for detailed information on Trend buffer operation and use.

Sample Time – The rate at which the monitored parameter is sampled.

Post Samples – The number of samples taken after the trigger condition is detected.

Year – An integer value representing the year the trigger condition was detected

Month (1 – 12) – An integer value representing the month the trigger condition was detected.

Day (1 – 31) – An integer value representing the day the trigger condition was detected.

Hour (0 – 23) – An integer value representing the hour the trigger condition was detected.

Minute (0 – 59) – An integer value representing the minute the trigger condition was detected.

Second (0 – 59) – An integer value representing the second the trigger condition was detected.

Millisecond – An integer value representing the 10's of milliseconds in which the trigger condition was detected.

Monitored Parameter Descriptor – An integer value used by Allen-Bradley program terminals to display the proper units for the monitored parameter.

Block #1: This Block contains data samples 0 through 33 for the trend buffer specified in the PMW instruction.

PMR Instruction Length: 38 words
MSG Size in Elements: 38

PLC Message Read

0	Header Word 1
0	Header Word 2
Function Code 270	Header Word 3
See Note	Header Word 4
1	Data Word 5
Data Sample #1	Data Word 6
Data Sample #2	Data Word 7
–	Data Word x
Data Sample #33	Data Word 38

Data Samples – The data samples are specified in Drive Units and may need to be scaled by the PLC Controller prior to being used in the program.

NOTE: Word 4 of the PLC Message Read instruction is broken down into two bytes. The High byte contains the status bits The Low byte contains the Drive message length in bytes.

Block #2: This Block contains data samples 34 through 66 for the trend buffer specified in the PMW instruction.

BTR Instruction Length: 38 words
MSG Size in Elements: 38

PLC Message Read

0	Header Word 39
0	Header Word 40
Function Code 270	Header Word 41
See Note	Header Word 42
2	Data Word 43
Data Sample #34	Data Word 44
Data Sample #35	Data Word 45
–	Data Word x
Data Sample #66	Data Word 76

Data Samples – The data samples are specified in Drive Units and may need to be scaled by the PLC Controller prior to being used in the program.

Block #3: This Block contains data samples 67 through 99 for the trend buffer specified in the PMW instruction.

PMR Instruction Length: 38 words

PLC Message Read

0	Header Word 77
0	Header Word 78
Function Code 270	Header Word 79
See Note	Header Word 80
2	Data Word 81
Data Sample #67	Data Word 82
Data Sample #68	Data Word 83
–	Data Word x
Data Sample #99	Data Word 104

Data Samples – The data samples are specified in Drive Units and may need to be scaled by the PLC Controller prior to being used in the program.

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Installation

Chapter Objective

This chapter is a detailed step-by-step procedure for the proper installation of the Bulletin 1395 ControlNet Adapter Board. Procedures performed in this chapter include:

- Unpacking and inspection
- Proper mounting
- Connection & Switch Settings

Receiving

It is your responsibility to thoroughly inspect the equipment before accepting shipment from the freight company. You must take the responsibility for noting any damage. Do Not accept shipment before checking all items received against the purchase order, and noting any missing or damaged items on the freight bill.

If any concealed damage is found later during unpacking, it is your responsibility to notify the freight agent. Leave the shipping container intact and request that the freight agent make a visual inspection of the shipment.

ATTENTION: This Drive contains ESD (Electrostatic Discharge) sensitive parts and assemblies. Static control precautions are required when installing, testing, servicing or repairing this assembly. Component damage may result if ESD control procedures are not followed. If you are not familiar with static control procedures, reference A-B publication 8000-4.5.2, *Guarding Against Electrostatic Damage* or any other applicable ESD protection handbook.

Unpacking & Inspection

Remove all packing material from around the board. Before removing the anti-static bag it should be noted that the CNA Board is a static sensitive device, and special precautions must be taken while handling the board. The circuit board can be damaged by Electrostatic Discharge. It is possible to make contact with an ESD sensitive component during installation. Therefore, personnel must be properly grounded. Grounding should be accomplished with a wrist strap which is connected to an approved ground.

If the board will not be installed when it is unpacked, it should be stored in a clean dry place in the anti-static bag. The storage temperature must be between 0°C (32°F) and +60°C (140°F) with a maximum humidity of 95% non-condensing, to guard against damage to temperature sensitive components.

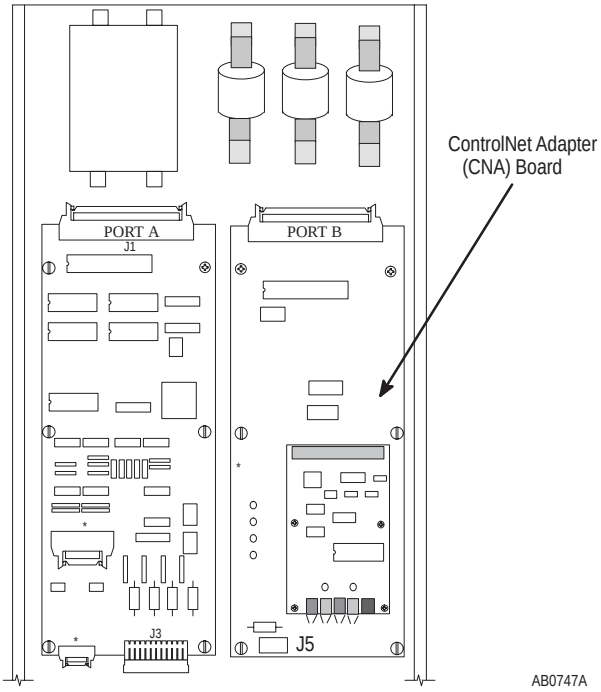
Mounting

The CNA Board is mounted on the front of the swing out panel. Two possible adapter board mounting positions are provided. When looking at the mounting positions from the front, the right position corresponds to Port B and the left to Port A. The standard port used

for the CNA board is port B, however if a second CNA Board will be installed in the same drive, it may be placed in Port A.

After determining which port will receive the CNA Board, mount the board, using the five (5) panel screws and one phillips head screw supplied (Figure 4.1).

Figure 4.1. ControlNet Adapter Board Location



Main Board Connections

The 60 pin ribbon cable connector (J1) located on the CNA Board (See Figure 4.1) provides a means of connecting the board to the Bulletin 1395 Main Control Board port connector (J6 or J7). The port connector used is determined by the port and physical location selected for installation of the CNA board. Main Control board connector J6 corresponds to Port B while J7 corresponds to Port A.

TE Ground Connection

Connect J5 pin 4 located on the CNA Board to the TE ground (Fig. 4.2).

ATTENTION: Failure to make this TE connection may cause nuisance faults or intermittent operation.

Input Connections

Connection to the Allen-Bradley ControlNet network is accomplished through two fiber connector pairs (Primary or Redundant) located on the bottom of the CNA board (Refer to Figure 4.2). The first step is to determine what channel configuration will be used. The next two sections explain how to connect the ControlNet network to the Drive.

Switch Settings

The CNA Adapter contains 4 DIP switches. ONLY DIP SWITCH U6 is used in this application.

NOTE: DIP Switch orientation on the CNA board is as follows:
CLOSED = “ON” = “1”
OPEN = “OFF” = “0”

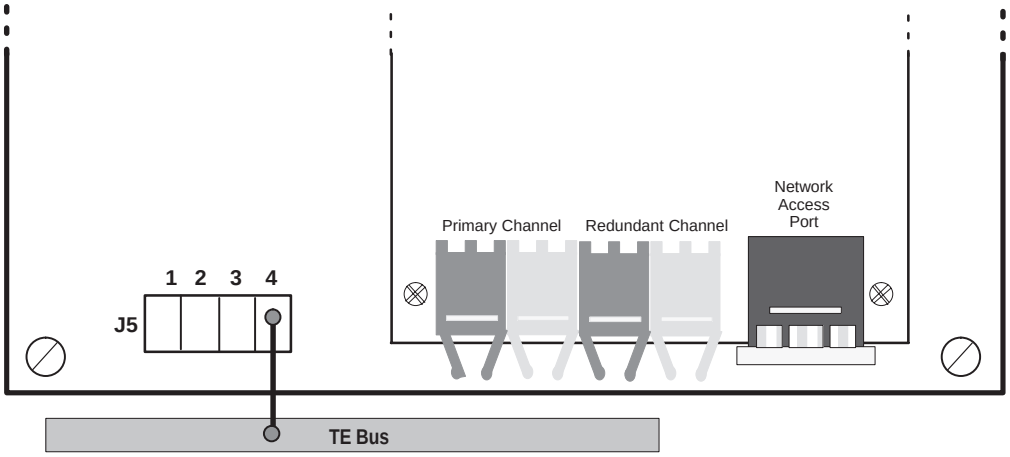
ATTENTION: The switch settings are read by the Drive when it is powered up and/or when a “System Reset” is performed. If changes are made to the switch settings after one of these occurrences they will not take effect until the next power-up or “System Reset” is performed. Any illegal DIP switch settings or combinations are annunciated with a fault.

When setting up the CNA board the following steps are needed:

1. Determine the node address (U6)
2. Make physical wire connections

Note: Redundancy is determined by the configuration tool (RS Network). No switch setting or jumper is necessary when running a redundant connection from the CNA board to the PLC.

Figure 4.2. TE Bus Connections



Switch settings for Node Address (switch U6):

Switch positions 2-8 determine the node address of the CNA adapter. Refer to Table 4.A for details. Switch position 1 is reserved for the PLC.

Table 4.A. Switch settings for Node Address (U6)

ControlNet Address	Switch positions							
		2	3	4	5	6	7	8
1*	Off	Off	Off	Off	Off	Off	Off	On
2	Off	Off	Off	Off	Off	Off	On	Off
3	Off	Off	Off	Off	Off	Off	On	On
4	Off	Off	Off	Off	Off	On	Off	Off
5	Off	Off	Off	Off	Off	On	Off	On
6	Off	Off	Off	Off	Off	On	On	Off
7	Off	Off	Off	Off	Off	On	On	On
8	Off	Off	Off	Off	On	Off	Off	Off
9	Off	Off	Off	Off	On	Off	Off	On
10	Off	Off	Off	Off	On	Off	On	Off
11	Off	Off	Off	Off	On	Off	On	On
12	Off	Off	Off	Off	On	On	Off	Off
13	Off	Off	Off	Off	On	On	Off	On
14	Off	Off	Off	Off	On	On	On	Off
15	Off	Off	Off	Off	On	On	On	On
16	Off	Off	Off	On	Off	Off	Off	Off
17	Off	Off	Off	On	Off	Off	Off	On
18	Off	Off	Off	On	Off	Off	On	Off
19	Off	Off	Off	On	Off	Off	On	On
20	Off	Off	Off	On	Off	On	Off	Off
21	Off	Off	Off	On	Off	On	Off	On
22	Off	Off	Off	On	Off	On	On	Off
23	Off	Off	Off	On	Off	On	On	On
24	Off	Off	Off	On	On	Off	Off	Off
25	Off	Off	Off	On	On	Off	Off	On
26	Off	Off	Off	On	On	Off	On	Off
27	Off	Off	Off	On	On	Off	On	On
28	Off	Off	Off	On	On	On	Off	Off
29	Off	Off	Off	On	On	On	Off	On
30	Off	Off	Off	On	On	On	On	Off
31	Off	Off	Off	On	On	On	On	On
32	Off	Off	On	Off	Off	Off	Off	Off
33	Off	Off	On	Off	Off	Off	Off	On
34	Off	Off	On	Off	Off	Off	On	Off
35	Off	Off	On	Off	Off	Off	On	On
36	Off	Off	On	Off	Off	On	Off	Off
37	Off	Off	On	Off	Off	On	Off	On
38	Off	Off	On	Off	Off	On	On	Off
39	Off	Off	On	Off	Off	On	On	On
40	Off	Off	On	Off	On	Off	Off	Off
41	Off	Off	On	Off	On	Off	Off	On
42	Off	Off	On	Off	On	Off	On	Off
43	Off	Off	On	Off	On	Off	On	On
44	Off	Off	On	Off	On	On	Off	Off
45	Off	Off	On	Off	On	On	Off	On
46	Off	Off	On	Off	On	On	On	Off

*Reserved

Table 4.A. Switch settings for Node Address (U6) cont.

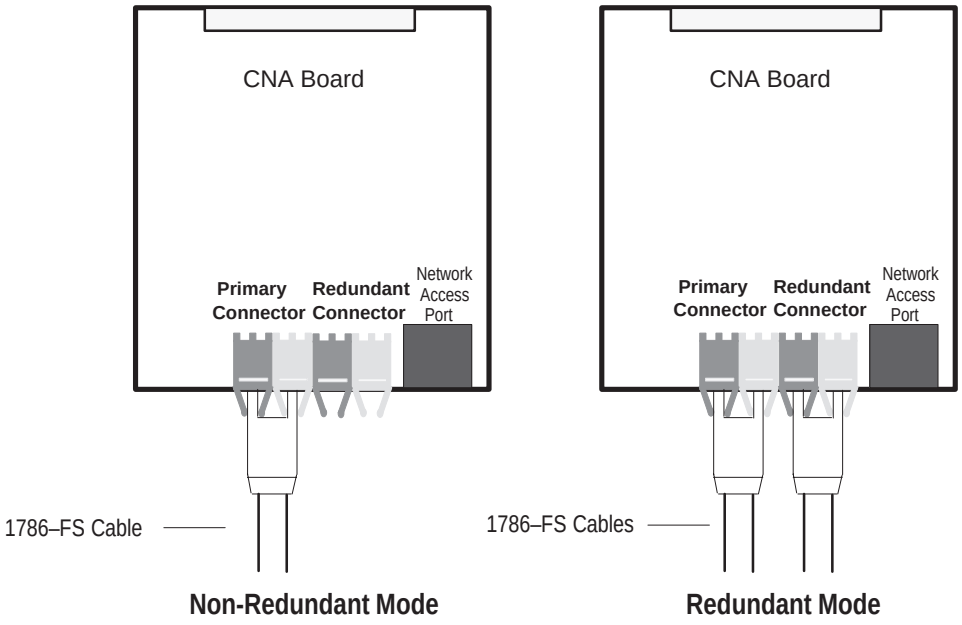
ControlNet Address	Switch positions							
	1	2	3	4	5	6	7	8
47	Off	On	On	Off	On	On	On	On
48	Off	On	On	On	Off	Off	Off	Off
49	Off	On	On	On	Off	Off	Off	On
50	Off	On	On	On	Off	Off	On	Off
51	Off	On	On	On	Off	Off	On	On
52	Off	On	On	On	Off	On	Off	Off
53	Off	On	On	On	Off	On	Off	On
54	Off	On	On	On	Off	On	On	Off
55	Off	On	On	On	Off	On	On	On
56	Off	On	On	On	On	Off	Off	Off
57	Off	On	On	On	On	Off	Off	On
58	Off	On	On	On	On	Off	On	Off
59	Off	On	On	On	On	Off	On	On
60	Off	On	On	On	On	On	Off	Off
61	Off	On	On	On	On	On	Off	On
62	Off	On	On	On	On	On	On	Off
63	Off	On	On	On	On	Off	On	On
64	Off	Off	Off	Off	Off	On	Off	Off
65	Off	Off	Off	Off	Off	Off	Off	On
66	Off	Off	Off	Off	Off	Off	On	Off
67	Off	Off	Off	Off	Off	Off	On	On
68	Off	Off	Off	Off	Off	On	Off	Off
69	Off	Off	Off	Off	Off	On	Off	On
70	Off	Off	Off	Off	Off	On	On	Off
71	Off	Off	Off	Off	Off	On	On	On
72	Off	Off	Off	Off	On	Off	Off	Off
73	Off	Off	Off	Off	On	Off	Off	On
74	Off	Off	Off	Off	On	Off	On	Off
75	Off	Off	Off	Off	On	Off	On	On
76	Off	Off	Off	Off	On	On	Off	Off
77	Off	Off	Off	Off	On	On	Off	On
78	Off	Off	Off	Off	On	On	On	Off
79	Off	Off	Off	Off	On	On	On	On
80	Off	Off	Off	On	Off	Off	Off	Off
81	Off	Off	Off	On	Off	Off	Off	On
82	Off	Off	Off	On	Off	Off	On	Off
83	Off	Off	Off	On	Off	Off	On	On
84	Off	Off	Off	On	Off	On	Off	Off
85	On	Off	Off	On	Off	On	Off	On
86	Off	Off	Off	On	Off	On	On	Off
87	Off	Off	Off	On	Off	On	On	On
88	Off	Off	Off	On	On	Off	Off	Off
89	Off	Off	Off	On	On	Off	Off	On
90	Off	Off	Off	On	On	Off	On	Off
91	Off	Off	Off	On	On	Off	On	On
92	Off	Off	Off	On	On	On	Off	Off
93	Off	Off	Off	On	On	On	Off	On
94	Off	Off	Off	On	On	On	On	Off
95	Off	Off	Off	On	On	On	On	On
96	Off	On	On	Off	Off	Off	Off	Off
97	Off	On	On	Off	Off	Off	Off	On
98	Off	On	On	Off	Off	Off	On	Off
99	Off	On	On	Off	Off	Off	On	On

ControlNet Connections

To make the ControlNet connection to the CNA board, connect the approved cable per Table 4.B to the CNA Board connector 1784-RPFS configured for ControlNet communications, and the ControlNet Network tap connector. Refer to Figure 4.3 for details on connecting to the CNA connectors in either redundant or non-redundant mode.

ATTENTION: When breaking connections at Channel A (and B when a redundant connection is present) on any CNA Board, communications will be interrupted to the 1395 Drive. Depending on the application, a loss of control to devices connected to the drive could cause hazardous system operation. To guard against personal injury, the system must be shut down, or local control maintained of critical devices when making or breaking connections at the Primary or Redundant Connection on the Board.

Figure 4.3. CNA Board ControlNet Connection



Note: Refer to the Fiber Optic Cable guidelines at the back of this chapter for details on cable type, length, etc.

Multiple Drive Connection – When more than one CNA board equipped Drive is connected to a ControlNet Network, it must have its own separate connection to the Network and a unique node address as determined by dip switch U6.

Cable Guidelines

The fiber optic cable used for ControlNet communications represents a communications transmission line in which certain characteristics exist. The following are some general guidelines which apply to this particular transmission line and should be adhered to in order to obtain the best possible results.

Note that these are general rules and certain deviations may be warranted since diverse installation and environmental concerns could change the requirements.

Cable Type – Recommended cables as shown in Table 4.B. These cables are available in precut, popular lengths for ease of use.

Table 4.B. Fiber Optic Cable Selection

Description	Catalog Number
200 Micron Cable Assembly 10 meters	1786 – FS10
200 Micron Cable Assembly 20 meters	1786 – FS20
200 Micron Cable Assembly 60 meters	1786 – FS60
200 Micron Cable Assembly 100 meters	1786 – FS100
200 Micron Cable Assembly 200 meters	1786 – FS200
200 Micron Cable Assembly 300 meters	1786 – FS300

IMPORTANT: Only use cables that are approved for ControlNet Applications. Refer to Bulletin 1786 ControlNet documentation for details.

Associated Hardware – The 1786–RPA module (Table 4.C) converts the coax cable through a CNet coax tap to up to four of the 1786–RPFS modules. The 1786 RPFS X has two connectors to receive the 200 Micron cable. The Drive ControlNet adapter board also has two connectors to receive the 200 Micron cable.

Table 4.C. Module Selection

Description	Catalog Number
ControlNet Modular Repeater Adapter	1786 – RPA
Short Distance Fiber Module – 300 meters	1786 – RPFS

Note: The 1786-RPA must be powered from a 24 volt power supply

For additional information on repeater modules refer to the following publications:

1786-2.12 ControlNet Network System Overview
1786-5.12 ControlNet Modular Repeater Short-distance Fiber Module Installation Instructions.
1786-5.13 ControlNet Modular Repeater Adapter Installation Instructions.

Fiber Optic Cable Routing

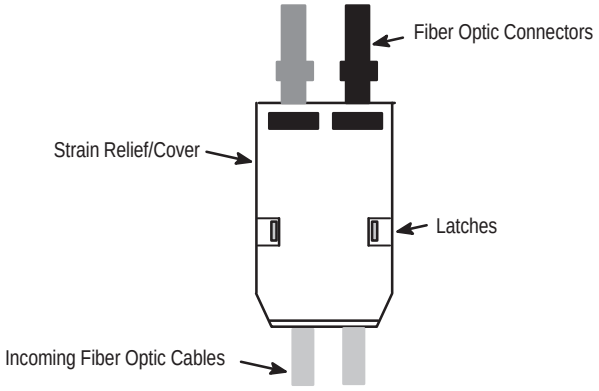
Special care should be taken when mounting and routing fiber optic cable to prevent damage that could degrade signal transmission.

– You must maintain a minimum bend radius of 1 inch at all times. If you cannot maintain this bend radius due to cabinet constraints, remove the plastic strain relief as shown in Figure 4.4 to allow you to maintain the bend radius at 1”.
If the strain relief is removed, connect the cable with the blue connector to the dark gray connection on the board. Connect the cable with the black connector to the light gray connection on the board. The cable with the blue connector is the receive (RX) cable, and the cable with the black connector is the transmit (TX) cable.

– If the strain relief is removed from the cable assembly, the cable weight may need to be be supported to prevent the connectors from unplugging in some applications. If your application has a long cable droop, or an unsupported wire bundle, use a zip tie to support the excess weight.

– If a cable is kinked or nicked during installation, it MUST be replaced. A kinked or damaged cable greatly reduces signal strength and could cause the drive to fault.

Figure 4.4. Strain Relief Components



To remove the strain relief/latching cover squeeze the two latches inward and lift the upper half off from the cable end (bottom) of the cover assembly.

Start–Up

Chapter Objectives

This chapter will provide you with the basic procedures that are necessary to configure the Drive for use with a CNA Board. Procedures that will be covered in this chapter include:

- Verification of proper installation and wiring.
- Verification of correct switch settings for the required application.
- Configuration of the Drive control for use with the CNA Board.

Terminology

Configuration	The process of linking Sink to Source parameters.
Interface	The hardware and associated software required to transfer information and/or control signals from one device to another.
Parameter	Memory location used to store Drive data.
Sink	Parameter used to receive data input
Source	Parameter used as a source of data.

Connection Verification

Before any attempt to configure the Drive is made, the following connections and settings MUST be verified per Chapter 4.

- Check the ControlNet Adapter Board mounting location. Is it in the correct position to connect to the intended port?
- Check that the 60 pin ribbon cable connector J1 is connected correctly for the location and port being used by the CNA board.
- Check that the DIP switch U6 setting is correct for your application referring to the Tables in Chapter 4, the Installation chapter.

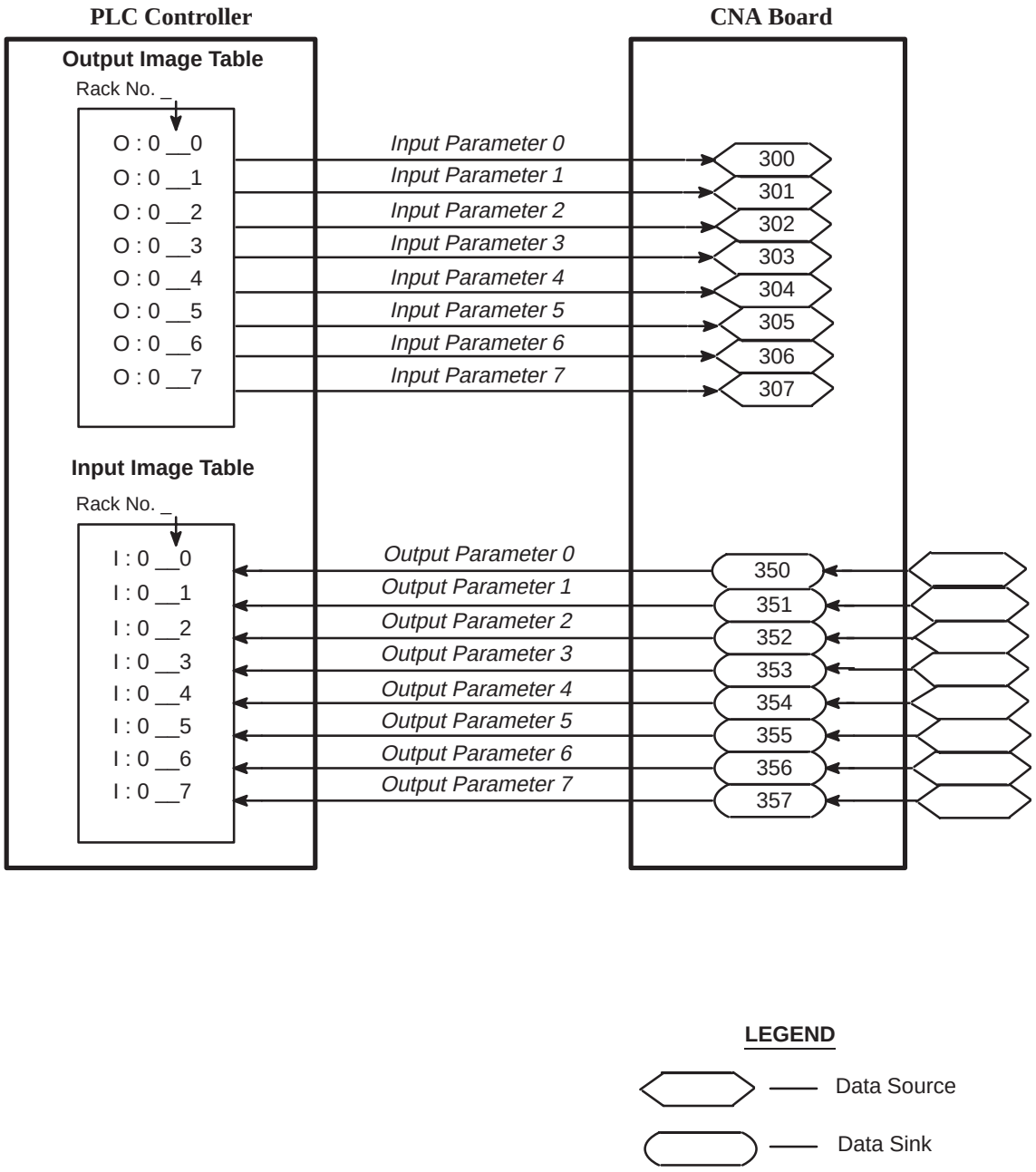
IMPORTANT: When an CNA Board is put in a different Drive Port, the Drive must be re-initialized for a correct CNA configuration to occur.

ATTENTION: Failure to verify connections and switch settings before configuring the Drive, could result in personal injury due to a Drive malfunction or erractic system operation.

Example Connection Configuration

The parameters used to configure the CNA board are determined by the port the CNA board is connected to. Figure 5.1 shows a sample configuration with the CNA board connected to Port B.

Figure 5.1. Configuration Example, CNA Board in Port B with Channel A designated for ControlNet



Troubleshooting

Chapter Objectives

This section describes the CNA board fault diagnostics and how they are processed by the 1395 Drive. Using the CNA Fault Board messages will help you to isolate problem areas and initiate possible solutions.

ATTENTION: Only qualified personnel familiar with the 1395 Drive system should perform troubleshooting or maintenance functions on the CNA Board. Failure to comply may result in personal injury and/or equipment damage. All precautions detailed in the 1395 Instruction Manual troubleshooting section must be followed when attempting to diagnose CNA board malfunctions.

ATTENTION: When performing any troubleshooting on a 1395 Drive equipped with a ControlNet adapter board make certain to check the Network Update Time (NUT). A NUT less than 5ms may cause data transfers to (and from) the drive to become non–deterministic.

The CNA Board provides initial fault handling based on conditions within its environment, and then signals the Bulletin 1395 which provides further disposition based on system requirements. Faults are divided into three categories:

Hard Faults

Hard Faults are non-recoverable and are the highest priority fault. That is, the Bulletin 1395 must either be RESET or POWER-CYCLED after the fault condition is corrected. The CNA Board transmits its fault to the Main Control Board through the dual-port RAM as explained in the Bulletin 1395 Instruction Manual. A Hard Fault in an adapter is designed to initiate an ECOAST Stop Sequence (Refer to the 1395 Manual for an in-depth explanation). The following example is considered a Hard Fault:

- Plug Failure

Internal diagnostics within the plug indicated a malfunction that rendered the plug inoperable.

Soft Faults

Soft Faults occur when an Adapter Board detects a condition which may result in undesirable operation. Soft Faults differ from Hard Faults in that the 1395 Drive can (in most cases) maintain proper control during a Soft Fault condition. The Adapter takes appropriate action within its domain to guard against degradation of Drive performance and signals the condition to the 1395 Drive. In addition,

the fault may be cleared and normal operation resumed at the point the fault occurred. An example of a Soft Fault is:

- CNA Comm Loss

Warning Faults

Warning Faults are the lowest priority and indicate error conditions which are generally transient in nature, but could result in undesirable operation if allowed to persist. If left uncorrected, Warning Faults could result in a Soft Fault. An example of a Warning Fault is:

- Class 3 Close

Selected Fault conditions in the Bulletin 1395 Drive can be configured in terms of their Soft or Warning Fault nature. That is, the user/operator may specify the action taken, either Soft Fault or Warning Fault (Report Only).

ATTENTION: Ignoring faults that have been configured as Report Only could damage certain components in the Drive.

Communication Fault Reporting and Handling

Connections and Transport Classes – ControlNet implements a producer–consumer model network. The drives support configurable point to point connections to and from other devices on the network. Every device has a physical connection to the network, but logical connections are also required between devices to support the exchange of data. Two transport classes are supported by the drives on ControlNet. These are transport class 1 and transport class 3. Class 1 connections are used to pass 8 16-bit words of I/O data (1 full rack) each direction between a Controller and a Drive deterministically at a configurable periodic rate. This type of data transfer corresponds to data being shared via Remote I/O. Class 3 connections are also supported for messaging between devices. This data is what would be sent over Data Highway Plus or with RIO block transfer.

Types of Communication Loss – Loss of data communications can be due to either physical or logical reasons. Below are definitions and examples of the primary causes of communications loss.

Comm Loss – If the drive becomes physically disconnected from the network, this is the most obvious form of communication loss. But the drive can also lose its logical connections in a variety of ways. The network could be inoperable due to some required device being down or possibly if illegal data or noise is present on the network. The drive itself may be deemed illegal on the network for various reasons and will not be allowed to talk on the network. Any of these conditions may be reported as a general “ICN Comm Loss”. When this condition is reported, the drive is considered to be effectively disconnected from the network and unable to communicate in any way on the network.

Closed Connection – The drive is implemented as an adapter device on the network and does not inititiate connections. One scanner device is allowed to make a Class 1 connection to a drive. Many devices of various kinds can open Class 3 connections to the drive at any time. When this happens, this may be reported as a "Class 1 Close" or a "Class 3 Close".

Connection Timeout – All connections, once opened, must be maintained at some rate. If the drive does not receive data from from any open connection within some period of time, a timeout condition is flagged. This event can be reported as "Class 1 Timeout" or as "Class 3 Timeout".

Controller Not in Run Mode – In addition to a loss of data due to network errors or connections being lost, data may also be considered lost if the controller goes out of run mode for any reason. Data being received from a controller that is not in run mode is considered to be unreliable and is ignored by the drive. The condition of a controller transitioning out of run mode can be reported as "Reset/Prog/Test".

Actions Resulting from Loss of Data – Any of the communication losses described above can be handled in various ways. The condition can cause a soft fault, which will cause a drive to stop active operation. The condition can be reported as a warning which means the event is annunciated, but does not change the running state of the drive. The condition may also be ignored. Beyond this, the handling for the loss of the Class 1 I/O data can also be configured with "Last State" bits that are defined in a subsequent section of this document. These bits are used to define the action to be taken with the Input image being used by the drive. This image can be either left in its last received state or it can be zeroed. Loss of I/O image would occur for the following conditions:

Reset/Prog/Test *ICN Comm Loss*
Class 1 Close *Class 1 Timeout*

Parameters Relating to Communication Loss – Each drive has two parameters that define how the communications losses get handled. These parameters are called "ICN Fault Select" and "ICN Warning Select". Operation of bits within these parameters is essentially identical to similar parameters used for RIO/DH+ adapters which exist at these parameter numbers. Bit positions are identical for all of these parameters in a ControlNet Adapter as detailed in the following table:

Bit Position	Description
0	Reset/Program/Test
1	Last State
2	ICN Comm Loss
3	Class 1 Close
4	Class 3 Close
5	Class 1 Timeout
6	Class 3 Timeout

If any bit is set to one in the Fault Select word, then if the corresponding event occurs, the drive will Soft Fault, and thus not be running. If the fault was one that causes loss of I/O image to be received (0,2,3,5) then the Last State bit is used to define what should be done to the entire Input Image (all 8 words). If Last State is a *one*, the input image is left in the last state prior to the fault being detected. If Last State is a zero, then the 8 input words are all set to zero.

The Warning Select parameter is used to determine if any event not specified to be handled as a fault in the Fault Select word should be treated as a warning. If a bit is set to a *one*, then a warning annunciation will occur for the corresponding event, but only if the corresponding bit in the Fault Select word is a zero. If any of the events that cause loss of I/O data occur (0,2,3,5) and that event is being annunciated as a warning, then the Last State bit in the Warning Select word is used to determine the state of the Input image. This works identically to the Last State bit for events being handled as faults.

If any bit position is set to zero for both the Fault Select word and the Warning Select word, then the event corresponding to that bit is ignored (not annunciated as either a fault or a warning). The Warning Select's Last State bit is applied to the I/O image for the following events
ICN Comm Loss
Class 1 Close
Class 1 Timeout
The case of a Reset/Program/Test event occurring, but set set to be ignored will always result in the I/O image being left in the last state (not zeroed even if Warning Select's Last State bit is zero). This is consistent with the operation of the existing RIO adapters.

CNA Board Fault Messages

The fault messages produced by the CNA board are:

Message: CN-10-PLC OUT OF RUN MODE
Fault Type: Hard
Cause: PLC was switched from run mode to another mode.
Action: Check PLC mode switch and I/O control reset, if condition persists, replace adapter board.

Message: CN-12-CONTROL NET COMM LOSS
Fault Type: Soft/Warning/None
Cause: Communication Link Broken
Action: Check connections & cable. Check that PLC is operational.

Message: CN-13-CLASS 1 CLOSE
Fault Type: Soft/Warning/None
Cause: Scanner Device (PLC) closed the connection to the drive. This could be due to a timeout condition or due to action initiated by the Scanner due to programming or possible error recovery.
Action: Check connections & cable. Check state of the Scanner Device (PLC). Check programming within the PLC.

Message: CN-14-CLASS 3 CLOSE
Fault Type: Soft/Warning/None
Cause: Device closed a messaging connection to the drive. This could be due to a timeout condition or due to action initiated by the device due to programming or possible error recovery.
Action: Check connections & cable. Check the state of all devices that are configured on the network to have a class 3 connection to the drive. Check programming within the PLC or any other device with a class 3 connection to the drive.

Message: CN-15-CLASS 1 TIMEOUT
Fault Type: Soft/Warning/None
Cause: Drive timed out on scheduled control data reception from the Scanner Device (PLC).
Action: Check connections & cables. Check that PLC is operational. Check for general errors occurring on the network. Check that the network was not being re-configured.

Message: CN-16-CLASS 3 TIMEOUT
Fault Type: Soft/Warning/None
Cause: Drive timed out on scheduled control data reception from a device.
Action: Check connections & cables. Check that all devices that are configured on the network to have a class 3 connection to the drive operational. Check programming within the PLC or any other device with a class 3 connection to the drive. Check for general errors occurrring on the network. Check that the network was not being re-configured.

Message: CN-17-PLUG FAILURE
Fault Type: Hard
Cause: Internal Fault detected
Action: Check version of Adapter Board for compatibility with Main board. If condition persists, replace adapter board.

Message: CN-30-ADAPTER PROCESSOR FAULT
CN-31-ADAPTER PROCESSOR FAULT
CN-32-ADAPTER PROCESSOR FAULT
Fault Type: Warning
Cause: Adapter internal diagnostic malfunction.
Action: Check version of Adapter Board for compatibility with Main board.

Message: CN-44-ADAPTER PROCESSOR FAULT
Fault Type: Hard
Cause: Adapter internal diagnostic malfunction.
Action: Check version of Adapter Board for compatibility with Main Board. If condition persists, replace adapter board.

Message: CN-45-ADAPTER PROCESSOR FAULT
Fault Type: Hard
Cause: Adapter internal diagnostic malfunction.
Action: Check version of Adapter Board for compatibility with Main board. If condition persists, replace adapter board.

Message: CN-50-ILLEGAL MAC ID
Fault Type: Hard
Cause: Node address is <2 or >99
Action: Check dip switch settings and reset Drive, if condition persists replace adapter board.

Status LED Indications

Refer to Tables 2.A and 2.B for LED indications.

Periodic Maintenance

Preventative Maintenance

ATTENTION: Servicing energized industrial equipment can be hazardous. Severe injury or death can result from electrical shock, burn, or unintended actuation of controlled equipment. Recommended practice is to disconnect and lock out control equipment from power sources, and allow stored energy in capacitors to dissipate, if present. If it is necessary to work in the vicinity of energized equipment, the safety related work practices of NFPA 70E, Electrical Safety Requirements for Employee Workplaces, must be followed.

ATTENTION: Use of other than factory recommended test equipment as detailed below for solid state controls may result in injury to personnel, damage to the control or test equipment or unintended actuation of the controlled equipment. Potentially fatal voltages may result from improper useage of an oscilliscope or other test equipment. Refer to equipment safety instructions for all test equipment before using with the CNA board. All cautions and warnings that apply to servicing and troubleshooting a 1395 Drive found in the 1395 Instruction Manual, MUST be followed when servicing the CNA board.

Recommended Tools and Equipment – The following equipment is recommended for maintaining and troubleshooting a 1395 Drive and CNA board:

- Multimeter capable of 1000V DC/ 750V AC, with input resistance of at least 1 megohm.
- Test leads for multimeter
- Assorted screwdriver (phillips and blade) and a set of open end wrenches.
- Clamp-on Ammeter (AC and DC with current ratings to match drive ratings).
- Programming Terminal
- Dual trace oscilliscope with A minus B quasi differential capability.
- X100 probes for oscilliscope.

Periodic Inspection – Industrial control equipment should be inspected periodically. Inspection intervals should be based on environmental and operating conditions, and adjusted as indicated by experience. An initial inspection within 3 to 4 months after installation is suggested. Applicable parts of the following guidelines should be used:

Contamination – If inspection reveals that dust, dirt, moisture or other contamination has reached the control equipment or CNA board,

the cause must be eliminated. This could indicate an incorrect or ineffective enclosure, unsealed enclosure openings (conduit or other) or incorrect operating procedures. Dirty, wet or contaminated parts must be replaced unless they can be cleaned effectively by vacuuming or wiping.

Solid-State Devices – Solid-state devices require little more than a periodic visual inspection. Printed circuit boards should be inspected to determine whether all ribbon cables are properly seated in their connectors. Board locking tabs should also be in place. Necessary replacements should be made only at the PC board or plug-in component level. Solvents should not be used on printed circuit boards. Where blowers are used, air filters if supplied should be cleaned or changed periodically depending on the specific environmental conditions encountered. For additional information see NEMA Standards Publication No. ICS 1.1–1984 entitled: "Safety Guidelines for the Application, Installation and Maintenance of Solid-State Controls".

ATTENTION: This drive contains ESD (Electrostatic Discharge) sensitive parts and assemblies. Static control precautions are required when installing, testing, servicing or repairing this assembly. Component damage may result if ESD control procedures are not followed. If you are not familiar with static control procedures, reference A-B publication 8000-4.5.2, *Guarding Against Electrostatic Damage* or any other applicable ESD protection handbook.

Static Sensitive Items – While performing maintenance on the 1395 Drive and the ControlNet Adapter Board, special precautions must be observed in handling or touching certain static sensitive components in the cabinet. All circuit cards and SCR's in the Drive can be damaged by Electro-Static Discharge. If personnel will make contact with an ESD sensitive component during maintenance, they must be grounded. Grounding should be accomplished with a wrist strap which is connected to an approved ground.

Tests & Records

Final Check Out – After maintenance or repair of industrial controls, always test the control system for proper functioning under controlled conditions that avoid hazards in the event of a control malfunction.
"Keep Good Maintenance Records" – This rule will be most helpful in locating possible intermitttent problems by pointing to a particular area of recurring trouble within the overall system. Further, good maintenance records will help reduce major costly shutdowns by demanding the use of proper test equipment and an appropriate inventory of spare parts. For additional information see NFPA 70 B, RECOMMENDED PRACTICE FOR ELECTRICAL EQUIPMENT MAINTENANCE, published by the National Fire Protection Association.

Reference

Chapter Objective

This chapter provides you with an easy reference to the CNA board parameters. It includes a condensed table of all configuration and setup parameters and a complete description of each CNA board parameter.

Terminology

A brief description of terms and concepts covered in this chapter are:

Configuration	The process of linking sink to source parameters for the purpose of distributing data within the Drive or adapter(s).
Drive Units	The actual value of the parameter as it is stored internally in the Drive. Drive units are converted to engineering units or to hexidecimal by Allen-Bradley program terminals. All Drive units are stored using per unit numbering.
Engineering Unit	A label given to parameter data which specifies what units are used to display the parameter on programming terminals. Examples of engineering units include: RPM, Amps, %, etc.
Fast Parameter	Fast parameters are those which are updated rapidly. They are typically used for transmitting real time data to and from the Drive. Fast parameter values are not stored in non-volatile memory. Actual armature Current is an example of a fast parameter.
Microbus	An internal Drive mechanism designed by Allen-Bradley for exchanging information between microprocessors. The Microbus is used to transfer information between the CNA board and the Main Control board.
Port	A physical location on the Drive reserved for the connection of Adapter cards. Each Drive has two ports. The ports are identified in firmware as “Port A” and “Port B”.
Parameter	A memory location in Drive firmware used to store Drive data. This data can be real time data and/or Drive setup information. Each parameter has an assigned number and function. Parameters are displayed in engineering units when viewed from program terminals.
Parameter Table	A table which contains all parameters that are available in the Drive.

Source Parameter A parameter which contains real time information that is available for use by other devices. These devices can include PLC controllers, operator interface devices, program terminals, etc.

Sink Parameters Sink parameters accept data from other parameters which is then used by the Drive to perform the desired functions. An example of a sink is the external velocity reference parameter which accepts a speed reference from a device such as a PLC.

Detailed Parameter Listing

Certain parameter numbers and definitions in the CNA board are dependent on the specific channel assignments as detailed in Table 8.A.

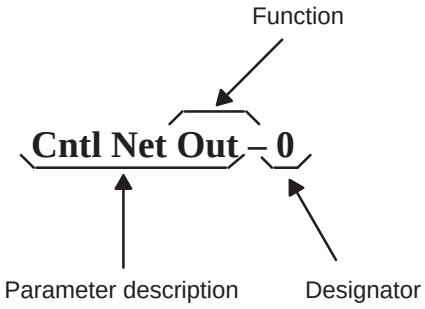
Table 8.A. CNA Board Parameter Channel Assignments

Parameter Numbers Port A	Parameter Numbers Port B	Useage
400 – 407	300 – 307	ControlNet Out
450 – 457	350 – 357	ControlNet In
550 – 554	500 – 504	ICN Fault/Warning – CNet Dip Switches

Parameter Name Structure

The example below shows a typical parameter name.

Parameter 300:



Parameter Table Structure

Table 8.B contains an abbreviated listing of the CNA board parameters. The parameters in the Adapter can be categorized into the following general groups by parameter number:

- #300 – #307 Port B Source Parameters
- #350 – #357 Port B Sink Parameters
- #400 – #407 Port A Source Parameters
- #450 – #457 Port A Sink Parameters
- #500 – #504 Port B Common Parameters
- #550 – #554 Port A Common Parameters

The column headings in Table 8.B are defined as follows:

DEC – The parameter number in decimal format.

HEX – The parameter number in hexidecimal format.

NAME – The parameter name as it appears on a program terminal.

UNITS – Indicates the engineering units used to display a parameter value when viewed on a program terminal.

INIT – The default parameter value stored in the Drive. The default values replace present values when a System Initialize command is given to the Drive.

MIN – The minimum allowable value for a parameter. If no minimum value is given, the parameter has not been assigned a minimum limit.

MAX – The maximum allowable value for a parameter. If no maximum value is given, the parameter has not been assigned a maximum limit.

EE – Indicates whether the parameter value is backed up in Drive EEPROM memory. In general, only setup parameter values are stored in EEPROM memory.

FUNCTION – Indicates the parameter type. The parameter type determines how the parameter is treated by the Drive and what type of information is contained within the parameter.

PORT – All Adapter board parameter numbers are determined by the Drive Adapter Port that the board is mounted in. When moving an Adapter board from one port to another, the functionality of the board remains the same, but specific functions will change.

Table 8.B. ControlNet Parameters

PORT	DEC	HEX	NAME	UNITS	INIT	MIN	MAX	EE	FUNCTION
B	300	12CH	B>CntlNet In 0	None	Not Changeable			NO	Fast Source
B	301	12DH	B>CntlNet In 1	None	Not Changeable			NO	Fast Source
B	302	12EH	B>CntlNet In 2	None	Not Changeable			NO	Fast Source
B	303	12FH	B>CntlNet In 3	None	Not Changeable			NO	Fast Source
B	304	130H	B>CntlNet In 4	None	Not Changeable			NO	Fast Source
B	305	131H	B>CntlNet In 5	None	Not Changeable			NO	Fast Source
B	306	132H	B>CntlNet In 6	None	Not Changeable			NO	Fast Source
B	307	133H	B>CntlNet In 7	None	Not Changeable			NO	Fast Source
B	350	15EH	B>CntlNet Out 0	None	Not Changeable			NO	Fast Sink
B	351	15FH	B>CntlNet Out 1	None	Not Changeable			NO	Fast Sink
B	352	160H	B>CntlNet Out 2	None	Not Changeable			NO	Fast Sink
B	353	161H	B>CntlNet Out 3	None	Not Changeable			NO	Fast Sink
B	354	162H	B>CntlNet Out 4	None	Not Changeable			NO	Fast Sink
B	355	163H	B>CntlNet Out 5	None	Not Changeable			NO	Fast Sink
B	356	164H	B>CntlNet Out 6	None	Not Changeable			NO	Fast Sink
B	357	165H	B>CntlNet Out 7	None	Not Changeable			NO	Fast Sink
A	400	190H	A>CntlNet In 0	None	Not Changeable			NO	Fast Source
A	401	191H	A>CntlNet In 1	None	Not Changeable			NO	Fast Source
A	402	192H	A>CntlNet In 2	None	Not Changeable			NO	Fast Source
A	403	193H	A>CntlNet In 3	None	Not Changeable			NO	Fast Source
A	404	194H	A>CntlNet In 4	None	Not Changeable			NO	Fast Source
A	405	195H	A>CntlNet In 5	None	Not Changeable			NO	Fast Source
A	406	196H	A>CntlNet In 6	None	Not Changeable			NO	Fast Source
A	407	197H	A>CntlNet In 7	None	Not Changeable			NO	Fast Source
A	450	1C2H	A>CntlNet Out 0	None	Not Changeable			NO	Fast Sink
A	451	1C3H	A>CntlNet Out 1	None	Not Changeable			NO	Fast Sink
A	452	1C4H	A>CntlNet Out 2	None	Not Changeable			NO	Fast Sink
A	453	1C5H	A>CntlNet Out 3	None	Not Changeable			NO	Fast Sink
A	454	1C6H	A>CntlNet Out 4	None	Not Changeable			NO	Fast Sink
A	455	1C7H	A>CntlNet Out 5	None	Not Changeable			NO	Fast Sink
A	456	1C8H	A>CntlNet Out 6	None	Not Changeable			NO	Fast Sink
A	457	1CAH	A>CntlNet Out 7	None	Not Changeable			NO	Fast Sink
B	500	1F4H	B>ICN Fault Sel	None	0XAF	0	0XFF	YES	Setup
B	501	1F5H	B>ICN Warn Sel	None	0	0	0XFF	YES	Setup
B	502	1F6H	B>ICN Fault Sts	None	Not Changeable			NO	Config
B	503	1F7H	B>ICN Warn Sts	None	Not Changeable			NO	Config
B	504	1F8H	B>ICN DIP Switch	None	Not Changeable			NO	Config
B	549	225H	B>Version	None	Not Changeable			NO	Config

Table 8.B. ControlNet Parameters

PORT	DEC	HEX	NAME	UNITS	INIT	MIN	MAX	EE	FUNCTION
A	550	226H	A>ICN Fault Sel	None	0XAF	0	0XFF	Yes	Setup
A	551	227H	A>ICN Warn Sel	None	0	0	0XFF	Yes	Setup
A	552	228H	A>ICN Fault Sts	None	Not Changeable			No	Config
A	553	229H	A>ICN Warn Sts	None	Not Changeable			No	Config
A	554	22AH	A>ICN DIP Switch	None	Not Changeable			No	Config
A	599	281H	A>Version	None	Not Changeable			No	Config

*See Parameter Description

Parameter Descriptions

The format used to provide information about CNA board parameters is as follows:

Parameter AAA [Parameter name]
BBB [Parameter name]
Use:
Parameter Type:
Program Terminal Units:
Minimum Value:
Maximum Value:
Default Value:
Description:

Parameter AAA – The parameter number if the Adapter is installed in Port A.

Parameter BBB – The parameter number if the Adapter is installed in Port B.

[Parameter name] – The parameter name as viewed on a program terminal.

Use – A brief description of the parameter function.

Parameter Type – Specifies the type of parameter. Two types are available on the CNA board:

Configuration parameters – These parameters contain real time information. They can be linked to Drive parameters or other CNA board parameters.

Setup parameters – These parameters are used to control CNA board functions and features.

Program Term Units – The engineering units used when displaying a parameter on a program terminal.

Minimum Value – The minimum allowable value for a parameter. If no minimum value is given, the parameter has not been assigned a minimum limit. This value is displayed on program terminals.

Maximum Value – The maximum allowable value for a parameter. If no maximum value is given,the parameter has not been assigned a maximum limit. This value is displayed on program terminals.

Default Value – The default parameter value stored in the Drive. The default values replace present values when a System Initialize command is given to the Drive.

Description – A detailed description of the use and operation of the parameter.

Parameters

This section describes in detail the function of each of the parameters on the CNA board.

Parameter 400 – [A>CntlNet In 0]
Parameter 300 – [B>CntlNet In 0]

Use: ControlNet Input word #0
Parameter Type: Fast Source
Program Terminal Units: None
Minimum Value: (Link Dependent)
Maximum Value: (Link Dependent)
Default Value: None

Description: This parameter is a fast source that contains the first word or group of data from the PLC controller output image table.

Parameter 401 – [A>CntlNet In 1]
Parameter 301 – [B>CntlNet In 1]

Use: ControlNet Input word #1
Parameter Type: Fast Source
Program Terminal Units: None
Minimum Value: (Link Dependent)
Maximum Value: (Link Dependent)
Default Value: None

Description: This parameter is a fast source that contains the second word or group of data from the PLC controller output image table.

Parameter 402 – [A>CntlNet In 2]
Parameter 302 – [B>CntlNet In 2]

Use: ControlNet Input word #2
Parameter Type: Fast Source
Program Terminal Units: None
Minimum Value: (Link Dependent)
Maximum Value: (Link Dependent)
Default Value: None

Description: This parameter is a fast source that contains the third word or group of data from the PLC controller output image table.

Parameter 403 – [A>CntlNet In 3]
Parameter 303 – [B>CntlNet In 3]

Use: ControlNet Input word #3
Parameter Type: Fast Source
Program Terminal Units: None
Minimum Value: (Link Dependent)
Maximum Value: (Link Dependent)
Default Value: None

Description: This parameter is a fast source that contains the fourth word or group of data from the PLC controller output image table.

Parameter 404 – [A>CntlNet In 4]
Parameter 304 – [B>CntlNet In 4]

Use: ControlNet Input word #4
Parameter Type: Fast Source
Program Terminal Units: None
Minimum Value: (Link Dependent)
Maximum Value: (Link Dependent)
Default Value: None

Description: This parameter is a fast source that contains the fifth word or group of data from the PLC controller output image table.

Parameter 405 – [A>CntlNet In 5]
Parameter 305 – [B>CntlNet In 5]

Use: ControlNet Input word #5
Parameter Type: Fast Source
Program Terminal Units: None
Minimum Value: (Link Dependent)
Maximum Value: (Link Dependent)
Default Value: None

Description: This parameter is a fast source that contains the sixth word or group of data from the PLC controller output image table.

Parameter 406 – [A>CntlNet In 6]
Parameter 306 – [B>CntlNet In 6]

Use: ControlNet Input word #6
Parameter Type: Fast Source
Program Terminal Units: None
Minimum Value: (Link Dependent)
Maximum Value: (Link Dependent)
Default Value: None

Description: This parameter is a fast source that contains the seventh word or group of data from the PLC controller output image table.

Parameter 407 – [A>CntlNet In 7]
Parameter 307 – [B>CntlNet In 7]

Use: ControlNet Input word #7
Parameter Type: Fast Source
Program Terminal Units: None
Minimum Value: (Link Dependent)
Maximum Value: (Link Dependent)
Default Value: None

Description: This parameter is a fast source that contains the eighth word or group of data from the PLC controller output image table. The value can be used by the CNA board directly or by other Drive functions through a configuration link.

Parameter 450 – [A>CntlNet Out 0]
Parameter 350 – [B>CntlNet Out 0]

Use: ControlNet Output word #0
Parameter Type: Fast Sink
Program Terminal Units: None
Minimum Value: (Link Dependent)
Maximum Value: (Link Dependent)
Default Value: None

Description: This parameter is a fast sink that provides the first word or group of data to the PLC controller input image table. The value can be provided by the CNA board directly or by other Drive functions through a configuration link.

Parameter 451 – [A>CntlNet Out 1]
Parameter 351 – [B>CntlNet Out 1]

Use: ControlNet Output word #1
Parameter Type: Fast Sink
Program Terminal Units: None
Minimum Value: (Link Dependent)
Maximum Value: (Link Dependent)
Default Value: None

Description: This parameter is a fast sink that provides the second word or group of data to the PLC controller input image table. The value can be provided by the CNA board directly or by other Drive functions through a configuration link.

Parameter 452 – [A>CntlNet Out 2]
Parameter 352 – [B>CntlNet Out 2]

Use: ControlNet Output word #2
Parameter Type: Fast Sink
Program Terminal Units: None
Minimum Value: (Link Dependent)
Maximum Value: (Link Dependent)
Default Value: None

Description: This parameter is a fast sink that provides the third word or group of data to the PLC controller input image table. The value can be provided by the CNA board directly or by other Drive functions through a configuration link.

Parameter 453 – [A>CntlNet Out 3]
Parameter 353 – [B>CntlNet Out 3]

Use: ControlNet Output word #3
Parameter Type: Fast Sink
Program Terminal Units: None
Minimum Value: (Link Dependent)
Maximum Value: (Link Dependent)
Default Value: None

Description: This parameter is a fast sink that provides the fourth word or group of data to the PLC controller input image table. The value can be provided by the CNA board directly or by other Drive functions through a configuration link.

Parameter 454 – [A>CntlNet Out 4]
Parameter 354 – [B>CntlNet Out 4]

Use: ControlNet Output word #4
Parameter Type: Fast Sink
Program Terminal Units: None
Minimum Value: (Link Dependent)
Maximum Value: (Link Dependent)
Default Value: None

Description: This parameter is a fast sink that provides the fifth word or group of data to the PLC controller input image table. The value can be provided by the CNA board directly or by other Drive functions through a configuration link.

Parameter 455 – [A>CnltNet Out 5]
Parameter 355 – [B>CntlNet Out 5]

Use: ControlNet Output word #5
Parameter Type: Fast Sink
Program Terminal Units: None
Minimum Value: (Link Dependent)
Maximum Value: (Link Dependent)
Default Value: None

Description: This parameter is a fast sink that provides the sixth word or group of data to the PLC controller input image table. The value can be provided by the CNA board directly or by other Drive functions through a configuration link.

Parameter 456 – [A>CnltNet Out 6]
Parameter 356 – [B>CntlNet Out 6]

Use: ControlNet Output word #6
Parameter Type: Fast Sink
Program Terminal Units: None
Minimum Value: (Link Dependent)
Maximum Value: (Link Dependent)
Default Value: None

Description: This parameter is a fast sink that provides the seventh word or group of data to the PLC controller input image table. The value can be provided by the CNA board directly or by other Drive functions through a configuration link.

Parameter 457 – [A>CnltNet Out 7]
Parameter 357 – [B>CntlNet Out 7]

Use: ControlNet Output word #7
Parameter Type: Fast Sink
Program Terminal Units: None
Minimum Value: (Link Dependent)
Maximum Value: (Link Dependent)
Default Value: None

Description: This parameter is a fast sink that provides the seventh word or group of data to the PLC controller input image table. The value can be provided by the CNA board directly or by other Drive functions through a configuration link.

Parameter 550 – [A>ICN Fault Select]
Parameter 500 – [B>ICN Fault Select]

Use: Selection for Soft Fault configuration
Parameter Type: Setup
Program Terminal Units: None
Minimum Value: 0
Maximum Value: 255 (FFh)
Default Value: 175 (AFh)

Description: Value of 1 in any bit position configures the fault condition to be a Soft Fault.

Parameter 551 – [A>ICN Warn Select]
Parameter 501 – [B>ICN Warn Select]

Use: Selection of Warning configuration
Parameter Type: Setup
Program Terminal Units: None
Minimum Value: 0
Maximum Value: 255 (FFh)
Default Value: 47 (2Fh)

Description: Value of 1 in any bit position configures the fault to be a Warning condition.

550 / 500 Fault Sel	551/501 Warn Sel	Treated and Reported as:	552/502 ICN Fault Status	553/503 ICN Warn Status
0	0	Ignore	0	0
0	1	Warning	0	1
1	0	Soft Fault	1	0
1	1	Soft Fault	1	1

Parameter 552 – [A>ICN Fault Status]
Parameter 502 – [B>ICN Fault Status]

Use: Displays ICN Fault Status
Parameter Type: Setup
Program Terminal Units: None
Minimum Value: 0
Maximum Value: 255 (FFH)
Default Value: 0

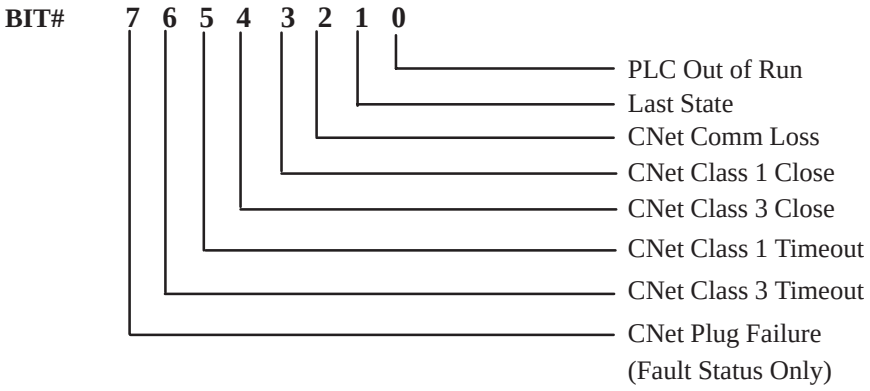
Description: Bit value of 1 indicates presense of Soft Fault condition

Parameter 553 – [ICN Warn Status]
Parameter 503 – [ICN Warn Status]

Use: Displays ICN Warning Status
Parameter Type: Source
Program Terminal Units: None
Minimum Value: 0
Maximum Value: 255 (FFh)
Default Value: 0

Description: Bit value of 1 indicates presense of Warning condition

Bit positions for previous four parameters:



Note: CNet Plug Failure is a Hard Fault and is not configurable as a Soft Fault or Warning.

Parameter 554 – [A>ICN DIP Switch]
Parameter 504 – [B>ICN DIP Switch]

Use: Display Power–Up state of DIP Switches
Parameter Type: Source
Program Terminal Units: None
Minimum Value: 1
Maximum Value: 99
Default Value: None

Description: State of U6 DIP switches at power up. These switches specify the ControlNet Node Address.

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